



Industry Report on Railway Concrete Sleepers, MS pipes and Infrastructure Services

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Vishal Nirmitti Limited

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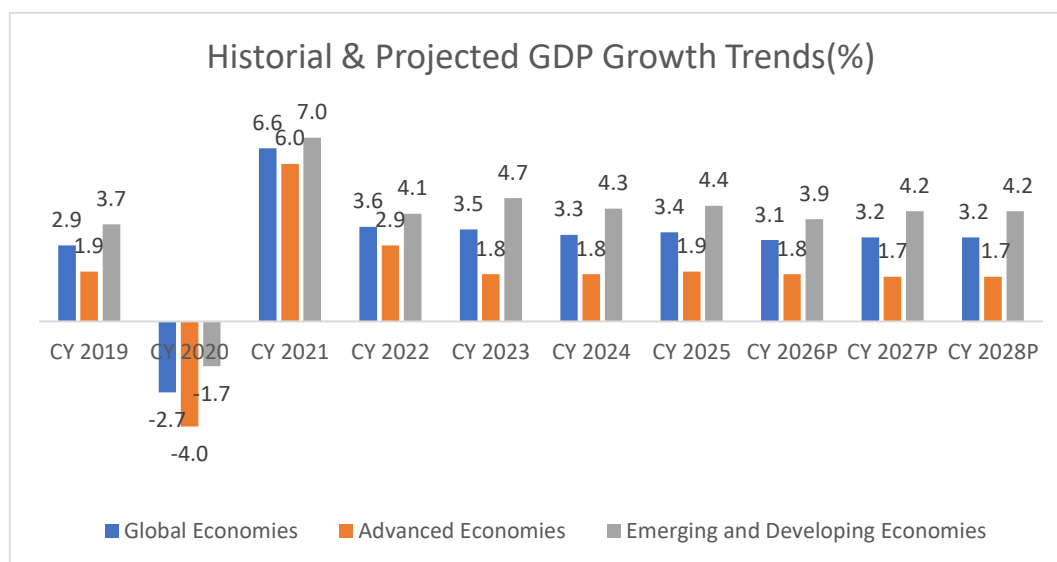
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Global Macroeconomic Scenario

Global Economic Overview

According to World Economic Outlook, global growth is projected at 3.1% in 2026 and at 3.2% in 2027 and 2028, slower than the recent pace of about 3.4% in CY 2024–25 and is expected to settle at approximately that rate over the medium term, below the historical average of 3.7% during 2000–19. The forecast for 2026 has been revised downward by 0.2 percentage point, while the forecast for 2027 and 2028 remains unchanged compared with the January 2026 WEO Update. Global headline inflation is expected to rise to 4.4% in 2026 and decline to 3.7% in 2027, reflecting upward revisions for both years.

The conflict involving US, Israel and Iran is increasingly functioning as a global supply and confidence shock. The International Energy Agency (IEA) describes the current situation as the largest oil supply disruption on record, with flows through the Strait of Hormuz reduced to a trickle and the resulting effects spreading across refined fuels and liquefied natural gas (LNG). At the same time, aviation disruptions and elevated risk premia are weakening services activity and increasing uncertainty around investment decisions. A significant share of global energy flows through the Strait of Hormuz, and shipping disruptions and insurance constraints are therefore translating directly into higher landed costs, supply chain delays, and greater output risks for energy-intensive manufacturing. As a result, the policy environment has increasingly become challenging, while growth support is required but renewed cost-push inflation across energy, freight, and eventually food inputs is limiting the scope for faster monetary easing.



Source – IMF Global GDP Forecast Release, April 2026

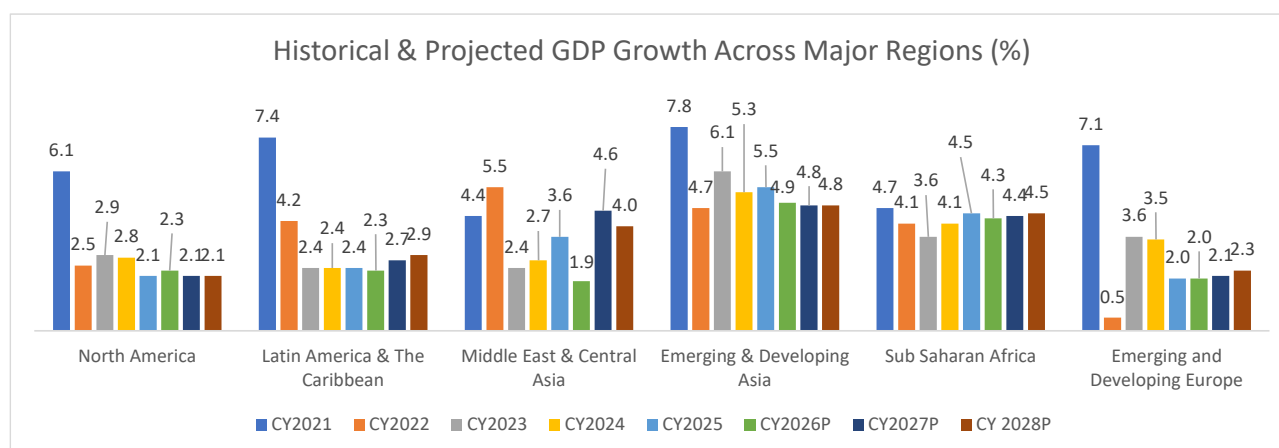
Note: Advanced Economies and Emerging & Developing Economies are as per the classification of the World Economic Outlook (WEO). This classification is not based on strict economic criteria and has evolved over time. It comprises 40 countries in the Advanced Economies category, including the G7 (the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada) and selected Eurozone members (Germany, Italy, France, etc.). The group of emerging and developing economies (156) comprises all economies not classified as Advanced Economies (e.g., India, China, Brazil, Malaysia).

Historical and Projected GDP Growth

GDP growth across major regions showed a mixed trend during 2024–25. While growth in several regions—including Middle East & Central Asia, Emerging and Developing Asia, Sub-Saharan Africa as well as Latin America and the Caribbean—is expected to slow further in 2026, performance remains uneven across geographies.

In the Middle East and Central Asia, economic growth is projected to decline from **3.6% in 2025** to **1.9% in 2026**, before recovering to **4.6% in 2027** and **4.0% in 2028**, reflecting the region's direct exposure to the conflict and the anticipated rebound thereafter. For commodity-exporting economies directly affected by the conflict, reduced production and export activity are expected to result in a significant downward revision to 2026 GDP growth projections.

Growth in emerging and developing Asia is projected to moderate from **5.5% in 2025** to **4.9% in 2026** and is further estimated to grow at **4.8% in 2027 and 2028**. Within the region, China's 2026 growth forecast has been revised upward by **0.2 percentage point** relative to the October estimate, to **4.4%**, despite a **0.1 percentage point downward revision** from January. This upward adjustment reflects the impact of lower effective U.S. tariff rates on Chinese goods, along with stimulus measures that are expected to offset the negative effects of the shock arising from the Middle East conflict. However, China's growth is projected to slow to **4.0% in 2027**, as structural headwinds continue to weigh on the economy, including the prolonged slowdown in the housing sector, a shrinking labor force, declining returns on investment, and weaker productivity growth.



Source- IMF World Economic Outlook, April 2026

In Latin America and the Caribbean, economic growth is projected to remain broadly stable at 2.3% in 2026 before strengthening to 2.7% in 2027 and 2.9% in 2028. The effects of the Middle East conflict across the region are expected to be uneven, with smaller economies likely to experience a more pronounced negative impact due to their relatively greater vulnerability to external shocks.

Growth in sub-Saharan Africa is projected to remain relatively stable at 4.3% in 2026 and 4.4% in 2027 and 4.5% in 2028. However, this regional outlook masks significant variation across countries, with some

economies expected to face more pronounced challenges than others. In particular, oil-importing and non-resource-intensive economies are likely to be adversely affected by the conflict in the Middle East, as heightened external pressures may weigh on economic activity and weaken growth prospects. In emerging and developing Europe, economic growth is expected to slow sharply to 2.0% in 2025 and recover only marginally thereafter, with the region projected to expand at an average rate of 2.0% in 2026, 2.1% in 2027 and 2.3% in 2028.

Global Economic Outlook

The conflict between Israel/the United States and Iran, which began in February, has developed into a global shock to transport, trade, and security planning. As a result, periodic airspace closures across Israel and parts of the Gulf, together with severe disruption to shipping through the Strait of Hormuz, have affected the movement of oil, oil products, and LNG. Consequently, businesses have faced longer and less reliable supply lines, higher freight and insurance costs, and more frequent “stop-go” operating conditions.

The near-term growth outlook has softened as the conflict is affecting both demand and costs. Disruption to the oil channel is coinciding with pressure on the non-oil outlook as travel and services weaken and risk premia rise. Airspace disruption has increased operating costs and reduced travel reliability, while higher jet fuel costs have added to pressure on carriers and freight forwarders.

Investment conditions have also tightened as higher regional risk premia have increased insurance, shipping, hedging, and working capital costs. At the same time, logistics disruption and higher input costs are raising inflation risks. Fertilizer and related input disruption is also creating a lagged risk to food prices.

Asia-Pacific: In Asia-Pacific, the conflict has created sustained stress for business continuity. Even with fighting paused, energy availability, shipping disruption, and insurance costs are expected to continue weighing on operations over the next quarter. Oil prices remain well above January levels despite easing from March peaks, while war-risk insurance, tighter tanker availability, and rerouting costs remain elevated. As a result, several fuel-importing economies—including Japan, South Korea, India, and parts of Southeast Asia—have faced power-conservation measures and fuel rationing, increasing the risk of operational downtime in energy-intensive sectors.

Shipping and supply chains are also facing second-round effects. Many Asia–Europe shipments have been diverted via the Cape of Good Hope, thereby extending lead times by 10–14 days. Although some routes have reopened, schedules remain compressed and insurers remain cautious, which has increased delivery deadline risk across manufacturing, particularly in chemicals, electronics, and pharmaceuticals. Input volatility and fertilizer disruption are also adding to inflation risks and thereby complicating the policy outlook.

Latin America: In Latin America, the U.S.-Israel-Iran conflict has increased energy market pressures, with higher Brent crude prices raising input costs and inflation risks across the region. Consequently, net hydrocarbon exporters such as Brazil, Colombia, and Ecuador are benefiting from stronger external balances,

while net energy importers—including Panama, Chile, and much of Central America—are facing higher import costs. Elevated fertilizer prices are also weighing on agricultural output and margins, including in Brazil and Argentina. In response, governments have introduced fuel subsidies and price controls.

Middle East & North Africa: In the Middle East and North Africa, the conflict continues to affect the region directly, with many countries facing missile and drone attacks from Iran in response to attacks by the United States and Israel on Iran. In the short term, economic growth is expected to slow sharply as exports decline, uncertainty constrains spending, and governments delay investment initiatives. The reduction in food imports is also expected to significantly affect countries with limited domestic production capacity. Bahrain, Qatar, and Kuwait remain highly dependent on imports through the Strait of Hormuz and therefore face risks of food shortages and concerns regarding social stability if disruption persists.

Sub-Saharan Africa: In Sub-Saharan Africa, the conflict continues to disrupt energy and fertilizer supply chains, thereby keeping the region under significant external pressure. Higher global oil prices are sharply rising fuel and transport costs for import-dependent economies such as Kenya, Uganda, Ethiopia, and Ghana. Policy responses have varied across the region. Ethiopia introduced emergency fuel subsidies in mid-March to contain domestic price increases, while Kenya is experiencing stronger pass-through from higher fuel costs, which is weighing on aviation, logistics, and export activity.

Global Growth Projection

Growth in advanced economies is projected at 1.8% in 2026 and 1.7% in 2027 and 2028, while the overall impact of the Middle East conflict is expected to remain modest, lowering 2026 growth by 0.2 percentage point relative to the pre-conflict forecast. This limited effect reflects positive terms-of-trade gains in the United States and stronger growth momentum, supported by government measures, in Japan, whereas more significant negative effects are expected mainly in net energy-importing economies, including the euro area and the United Kingdom. In the United States, growth is projected at 2.3% in 2026 and 2.1% in 2027 and 2028, with fiscal policy and the lagged effects of monetary easing in 2025 continuing to support activity, even as higher trade barriers since April 2025 weigh on growth. The 0.1 percentage point downward revision from the January 2026 WEO Update reflects a small negative effect from the war, but this is partly offset by a rebound following the end of the 2025 federal government shutdown, along with stronger productivity growth and positive carryover effects. Although the International Emergency Economic Powers Act (IEEPA) ruling may reduce tariff-related fiscal revenues, its impact on the fiscal balance and activity is expected to remain limited and spread over the forecast horizon. Growth in 2027 is expected to remain solid, supported by tax incentives, including those for corporate investment under the One, Big, Beautiful Bill Act (OBBBA), while technology-driven momentum is projected to moderate and productivity growth is expected to gradually converge toward historical norms.

Growth in emerging market and developing economies is projected to slow to 3.9% in 2026 before recovering to 4.2% in 2027 and 2028, while the Middle East conflict is expected to have a greater impact on this group than on advanced economies, reducing 2026 growth by 0.3 percentage point relative to the pre-conflict forecast. In emerging and developing Asia, growth is expected to moderate from 5.5% in 2025 to 4.9% in 2026 and 4.8% in 2027 and 2028. Within the region, China's 2026 growth forecast has been revised upward to 4.4%, as lower effective U.S. tariffs and stimulus measures offset the impact of the conflict, although growth is projected to slow to 4.0% in 2027 as structural headwinds intensify. India's growth outlook has also improved, with growth revised upward to 7.6% in 2025 and projected to remain at 6.5% in 2026, 2027 and 2028, supported by strong carryover effects and lower additional U.S. tariffs on Indian goods. Meanwhile, several South and Southeast Asian economies are expected to face weaker domestic demand due to lower tourism and remittance inflows, while the Philippines has seen a sharp downward revision for 2026.

In the Middle East and Central Asia, growth is projected to decline from 3.6% in 2025 to 1.9% in 2026, before rebounding to 4.6% in 2027 and 4.0% in 2028, reflecting the region's direct exposure to the conflict. The downturn is expected to be most severe among affected commodity exporters, particularly Bahrain, Iran, Iraq, Kuwait, and Qatar, while the impact is expected to be less severe in other economies. Accordingly, Iran's economy is projected to contract by (-) 6.1% in 2026, before rebounding to 3.2% in 2027 and moderating to 1.5% in 2028. By contrast, Saudi Arabia's growth is projected at 3.1% in 2026, rising to 4.5% in 2027 before easing to 3.6% in 2028. In sub-Saharan Africa, growth is expected to remain broadly stable at

4.3% in 2026, 4.4% in 2027, and 4.5% in 2028, although oil-importing economies are likely to face greater pressure, while Nigeria and South Africa are expected to record moderate but gradually improving growth profiles. In Latin America and the Caribbean, growth is projected at 2.3% in 2026, 2.7% in 2027, and 2.9% in 2028, with Brazil expected to benefit modestly in the near term from its position as a net energy exporter, while Mexico is projected to recover gradually to 1.6% in 2026, 2.2% in 2027, and 2.1% in 2028.

In emerging and developing Europe, the sharp slowdown in growth to 2.0% in 2025 is expected to reverse only marginally, with the region projected to expand at an average rate of 2.0% in 2026, 2.1% in 2027, and 2.3% in 2028. Within the region, Russia's 2026 growth forecast has been revised upward by 0.3 percentage point relative to January, to 1.1%, as higher commodity prices are expected to support activity. This momentum is projected to continue, with growth remaining at 1.1% in 2027 before moderating slightly to 1.0% in 2028. By contrast, Türkiye's 2026 growth forecast has been revised downward by 0.8 percentage point relative to the January 2026 WEO to 3.4%, as weaker-than-expected growth in 2025 and higher oil and gas prices are expected to weigh on activity.

Key factors impacting Global Macroeconomic landscape

- Geopolitics continues to constitute a major source of global macroeconomic and business risk. The Russia–Ukraine war remains a persistent driver of instability, as Russia has intensified large-scale missile and drone attacks on Ukrainian cities and infrastructure, while Ukraine has stepped up strikes on Russian ports, refineries, and export infrastructure, reportedly contributing to a reduction in Russian oil output in April. The Israel–Iran–U.S. confrontation has emerged as the most significant near-term external shock to the global economy, with the IMF warning that disruptions to the Strait of Hormuz and regional energy infrastructure could materially weaken global growth and raise inflation; under its April 2026 reference forecast, global growth has been lowered to 3.1% and inflation raised to 4.4%, with materially worse outcomes under prolonged disruption scenarios. In parallel, the Pakistan–Afghanistan border conflict remains a significant regional flashpoint, although China-mediated talks are seeking to secure a ceasefire and reopen border crossings after months of cross-border attacks and trade disruption. At the same time, U.S. strategic activism continues to influence regional risk perceptions: Washington has removed sanctions on Venezuela's interim leadership and deepened engagement with Caracas, tensions over Greenland have re-emerged amid renewed U.S. rhetoric and ongoing diplomatic discussions with Denmark and Greenland, and U.S.–Nigeria security cooperation has continued to deepen in response to regional instability and counterterrorism concerns. In addition, resource nationalism and strategic competition over rare earths and other critical minerals have become increasingly operational concerns rather than distant strategic risks. The IEA's April 2026 assessment notes that demand for magnet rare earths has doubled since 2015 and is projected to increase by more than 30% by 2030, while supply chains remain highly concentrated, with China accounting for around 60% of mined output, more than 90%

of refining, and nearly 95% of permanent magnet production, thereby heightening global exposure to export controls, supply concentration, and industrial policy interventions

- The period of relatively frictionless trade supported by multilateral liberalisation and free trade agreements is increasingly giving way to regionalisation, nearshoring, friend-shoring, and diversification of production networks. Rising tariffs, policy uncertainty, and strategic realignment are creating a more fragmented trade environment and raising the premium on resilience over pure efficiency
- Technology adoption and sustainability have become core strategic priorities. Organizations are advancing digital transformation by embedding AI, automation, and cybersecurity into their operations to enhance productivity and safeguard critical assets. AI adoption is emerging as a visible driver of optimism, particularly within the information and communications sectors. Growth in cloud computing, streaming, IoT, and AI and Advancements in hardware and cooling technologies aim to reduce energy consumption and improve performance is driving the need for more powerful and scalable data centres.

India Macroeconomic Analysis

India's economic growth outlook for 2025 has been revised upward by 1.0 percentage point from the October estimate to 7.6%, supported by stronger-than-expected performance in the second and third quarters of the fiscal year and sustained momentum in the fourth quarter. For 2026, the growth projection has been moderately increased by 0.3 percentage point (including a 0.1 percentage point upward revision from January) to 6.5%, primarily driven by the carryover effect of the strong 2025 performance and the reduction in additional U.S. tariffs on Indian goods from 50% to 10%, which more than offsets the adverse impact of the Middle East conflict. Growth is expected to remain steady at 6.5% in 2027. Across several South and Southeast Asian economies, disruptions linked to the Middle East conflict are anticipated to reduce tourism activity and remittance inflows, thereby weakening domestic demand and moderating overall economic performance.

Country	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026 P	CY 2027 P	CY 2028P
India ¹	-5.8%	9.7%	7.6%	9.2%	6.5%	7.6%	6.5%	6.5%	6.5%
China	2.3%	8.6%	3.1%	5.4%	5.0%	5.0%	4.4%	4.0%	4.0%
United States	-2.2%	6.1%	2.5%	2.9%	2.8%	2.1%	2.3%	2.1%	2.1%
Japan	-4.2%	2.7%	0.9%	1.4%	-0.2%	1.2%	0.7%	0.6%	0.6%
United Kingdom	-10.3%	8.6%	4.8%	0.4%	1.1%	1.3%	0.8%	1.3%	1.6%
Russia	-2.7%	5.9%	-1.4%	4.1%	4.3%	1.0%	1.1%	1.1%	1.0%
Germany	-4.1%	3.9%	1.8%	-0.9%	-0.5%	0.2%	0.8%	1.2%	1.2%

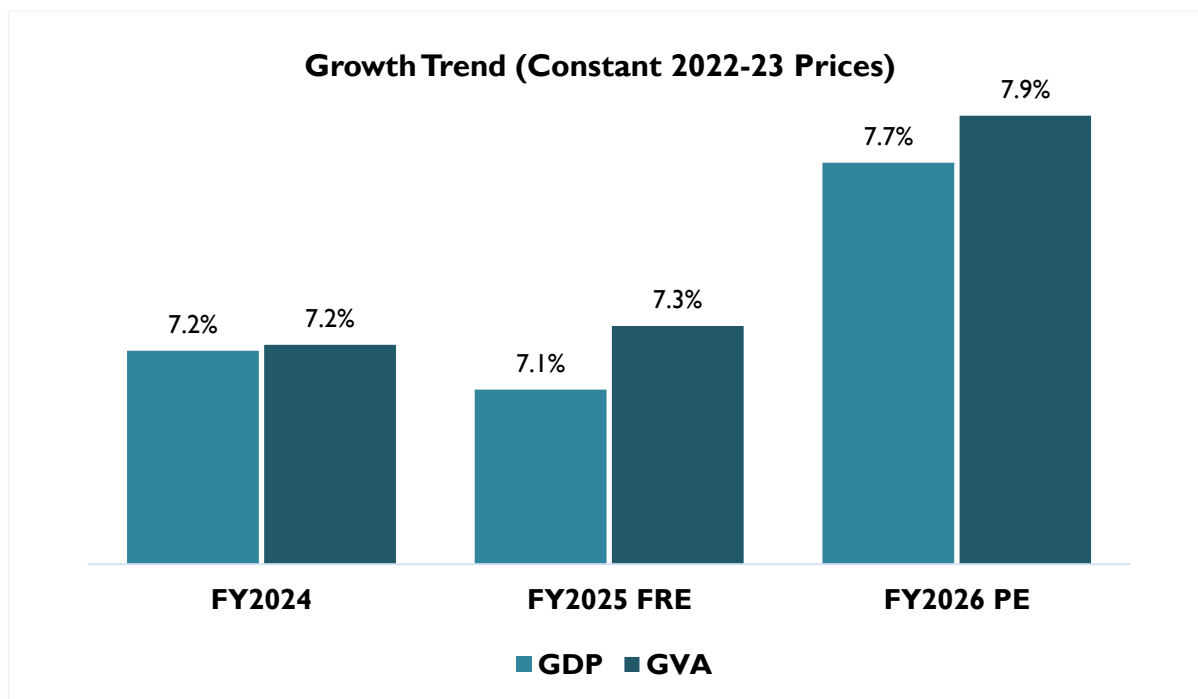
Source: World Economic Outlook, April 2026

Historical GDP and GVA Growth Trend

As per Provisional Estimates, India Real GDP (GDP at constant prices) for FY 2025–26 reached INR 323.12 lakh crore, compared to the First Revised Estimate (FRE) of INR 299.89 lakh crore for FY 2024–25. This represents a growth rate of 7.7% in 2025–26, higher than the 7.1% growth recorded in 2024–25.

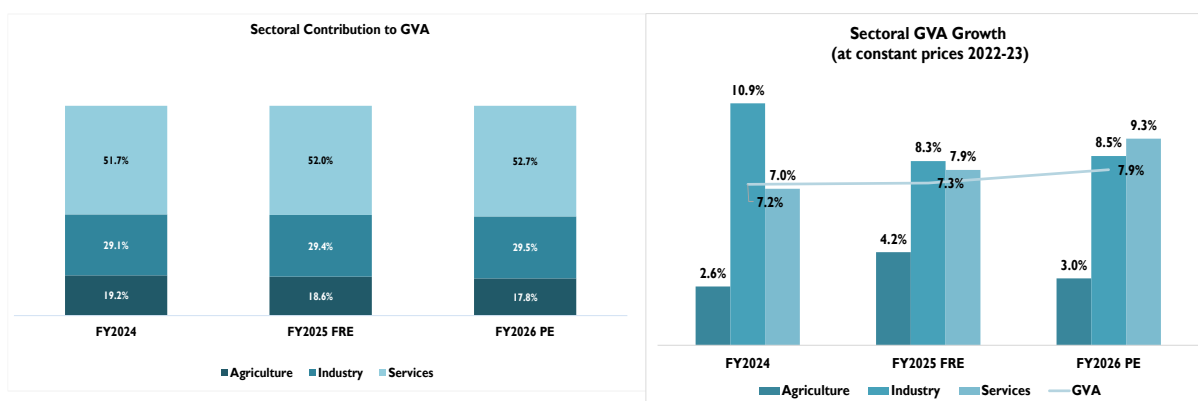
Similarly, Real GVA for FY 2025–26 reached INR 294.91 lakh crore, up from INR 273.36 lakh crore in FY 2024–25. This indicates a growth rate of 7.9%, compared with the 7.3% growth achieved in the previous year.

¹ For India, data and forecasts are presented on a fiscal year basis, and GDP from 2022 onward is based on GDP at market prices with fiscal year 2022/23 as a base year



Source: Ministry of Statistics & Programme Implementation (MOSPI), National Account Statistics: FY2025,
FRE is First Revised Estimate; PE is Provisional Estimates

Sectoral Contribution to GVA and Annual Growth Trend



Source: Ministry of Statistics & Programme Implementation (MOSPI), CMIE Economics Outlook
FRE is First Revised Estimate; PE is Provisional Estimates²

Sectoral analysis of GVA reveals that the industrial sector experienced steady growth momentum in FY 2026, recording a 7.9% y-o-y growth against 7.3% year-on-year growth in FY 2025. Within the industrial sector, growth moderated across sub-sectors with mining, and construction activities growing by 5.15%, and 7.36%, respectively in FY 2026, compared to 11.69%, and 7.30% in FY 2025. Growth in the utilities sector too moderated to 1.74% in FY 2026 from 2.87% in the previous year. The industrial sector's contribution to GVA increased marginally from 29.4% in FY 2025 to 29.5% in FY 2026.

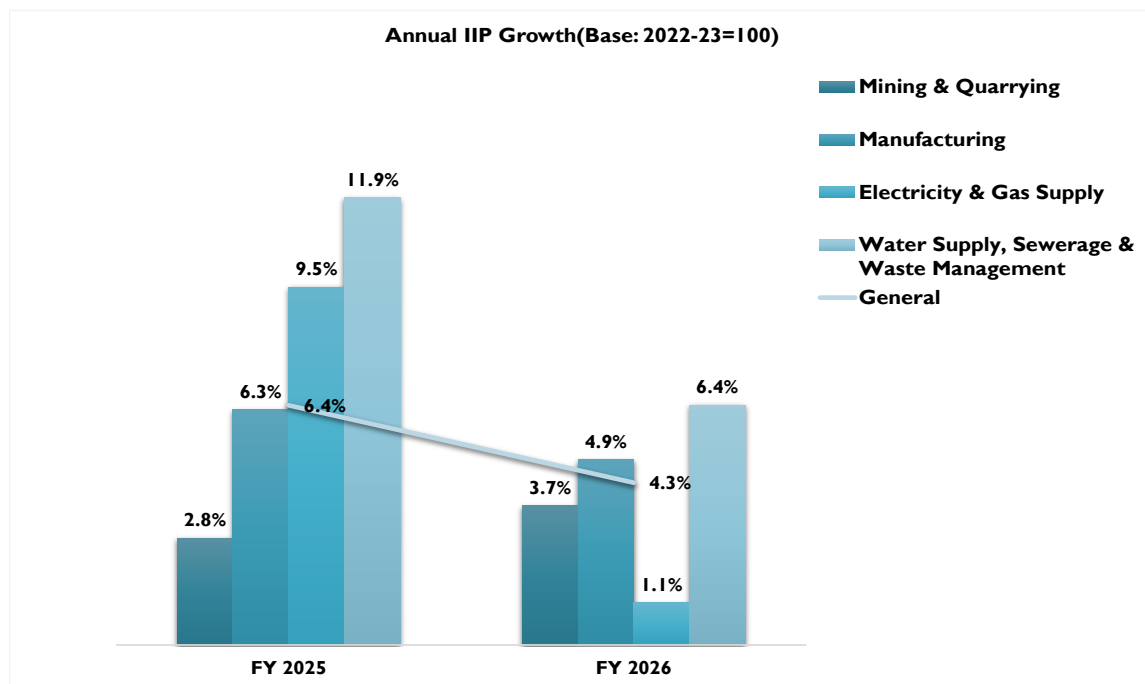
² https://www.mospi.gov.in/uploads/latestReleases/latest_release_1780655857536_5ac01869-ca4a-422d-b7a7-57b81da60932_Press_Note_on_GDP_Estimates_for_Q4_2025-26_and_PE_FY_2025-26_F.pdf

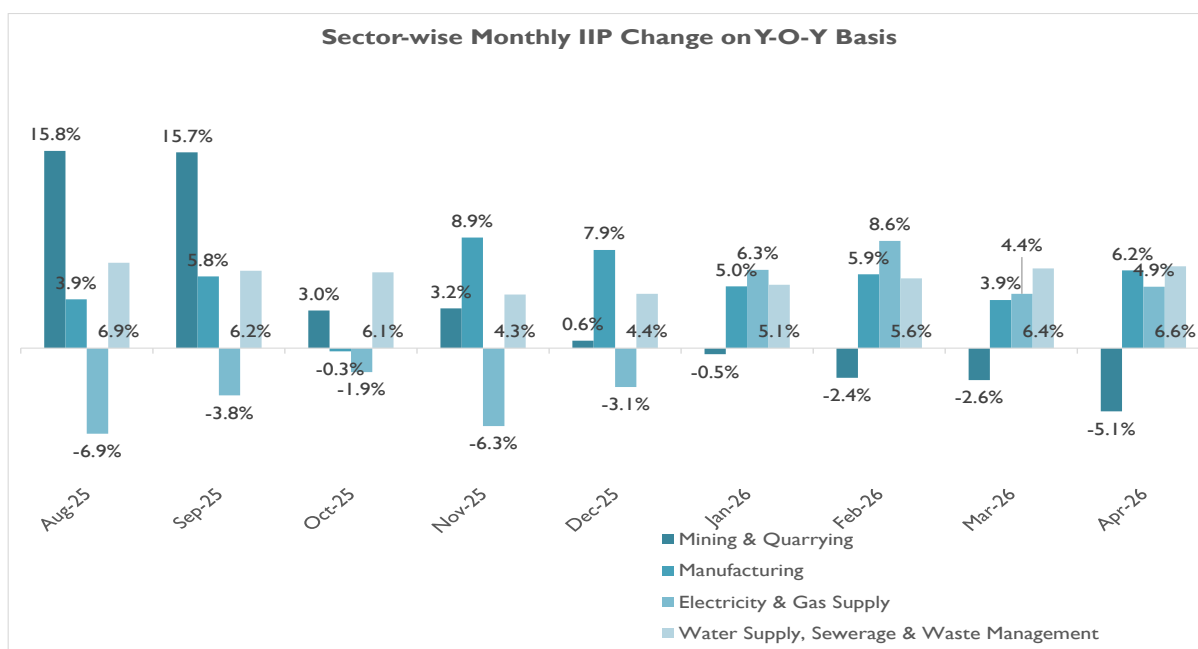
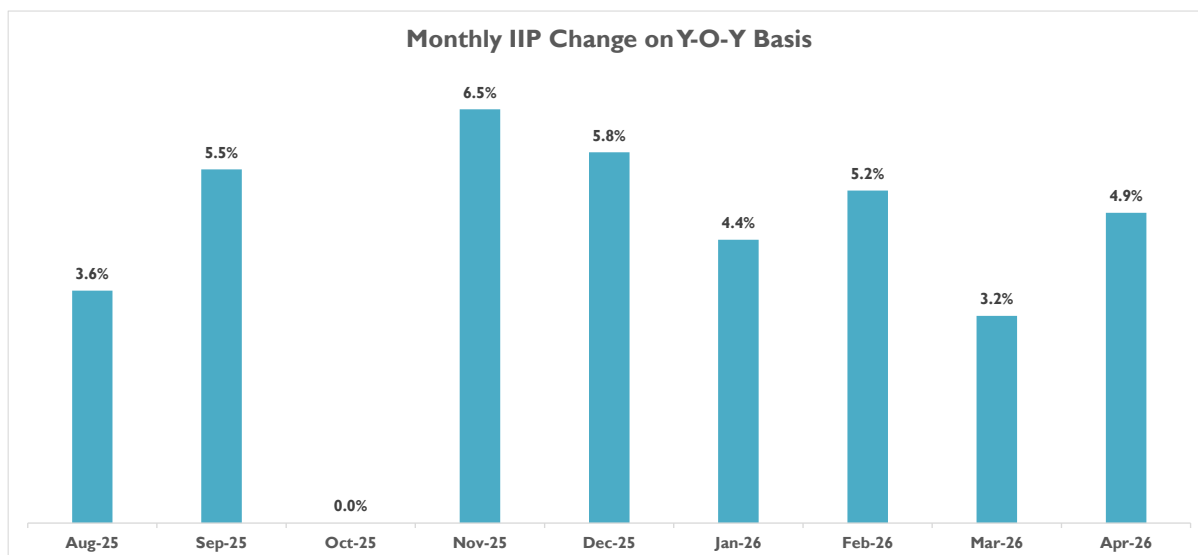
The services sector continued to be the main driver of economic growth. It expanded by 9.3% in FY 2026 from 7.9% in FY 2025. The services sector retained its position as the largest contributor to GVA, rising from 51.7% in FY 2024 to 52.0% in FY 2025, with a further increase to 52.7% in FY 2026.

The agriculture sector saw an acceleration in growth, increasing from 2.66% in FY 2024 to 4.18% in FY 2025, before moderating to 3.0% in FY 2026. However, its contribution to GVA declined marginally from 19.2% in FY 2024 to 17.8% in FY 2026. Overall, Gross Value Added (GVA) growth rose to 7.9% in FY 2026 from 7.3% in FY 2025.

Annual & Monthly IIP Growth

Industrial sector performance as measured by the IIP index exhibited moderation in FY 2026, recording a 4.3% y-o-y growth against 6.4% increase in the previous year. The manufacturing index showed moderation, increasing by 4.9% in FY 2026 compared with 6.3% in FY 2025. The Electricity & Gas Supply sector index also moderated, growing 1.1% in FY 2026 compared with 9.5% in the previous year. Water Supply, Sewerage & Waste Management also moderated by 6.4% in FY 2026 compared with 11.9% in the previous year, while the mining sector index grows by 3.7% in FY 2026 compared with 2.8% in the previous year.



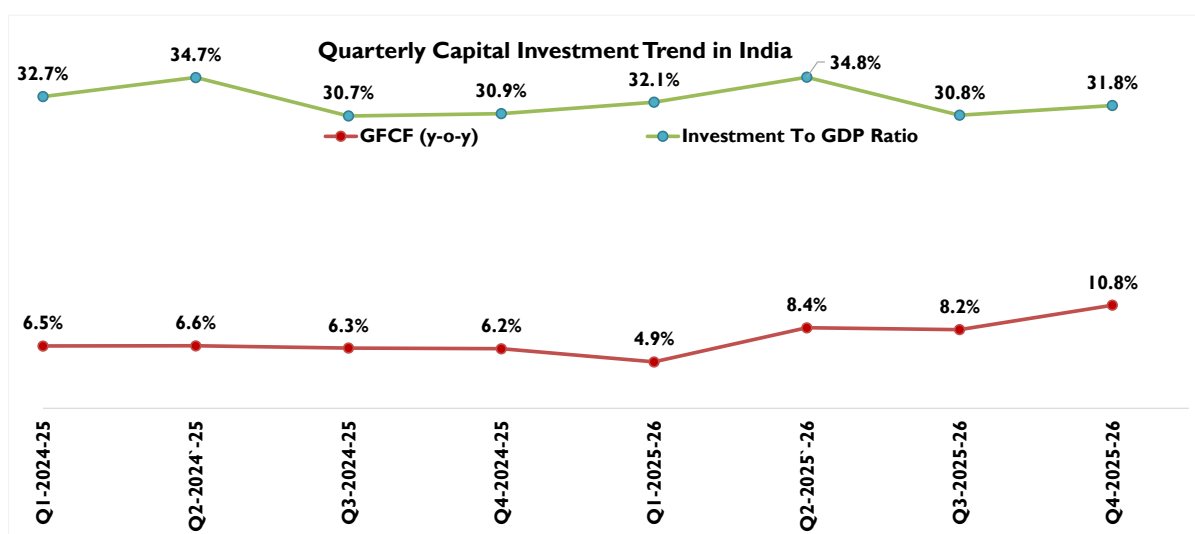
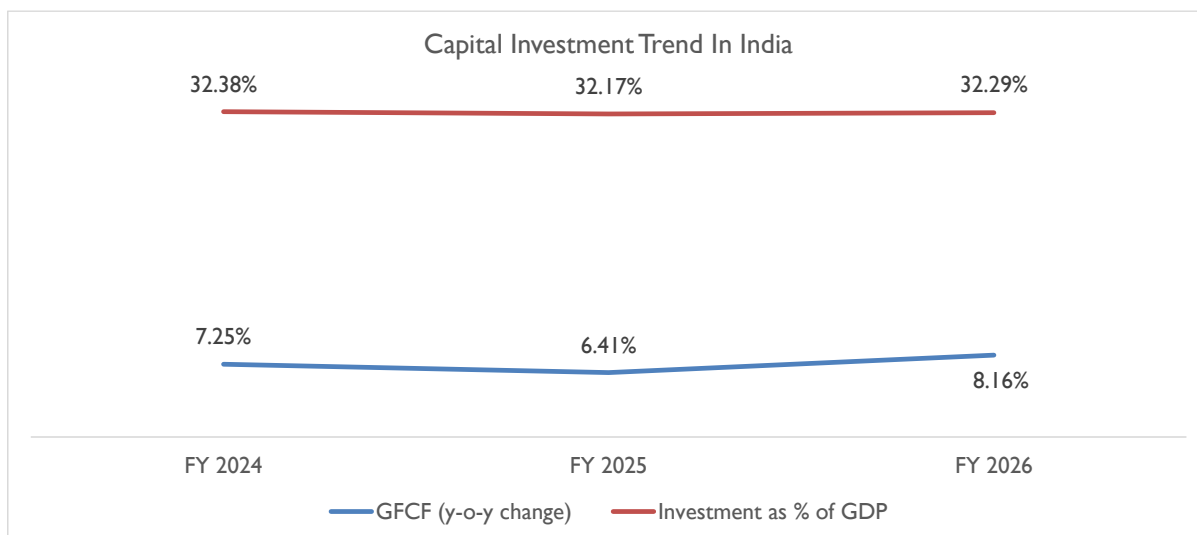


Source: Ministry of Statistics & Programme Implementation (MOSPI)

The IIP growth rate for the month of April 2026 is 4.9 percent as compared to April 2025. The growth rates of the Four sectors, Mining & Quarrying, Manufacturing, Electricity & Gas Supply and Water Supply, Sewerage & Waste Management for the month of April 2026 are (-)5.1 percent, 6.2 percent, 4.9 percent and 6.6 percent respectively

Annual and Quarterly: Investment & Consumption Scenario

Other major indicators, such as Gross Fixed Capital Formation (GFCF), a measure of investment, increased during FY 2026, registering 8.16% year-on-year growth compared with 6.41% in FY 2025, bringing the GFCF-to-GDP ratio to 32.29%.



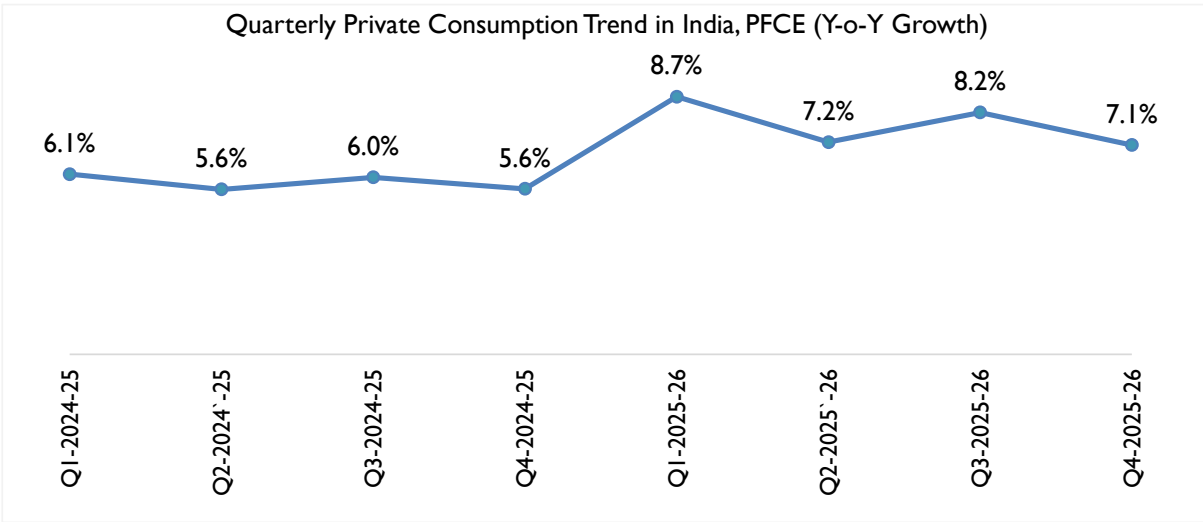
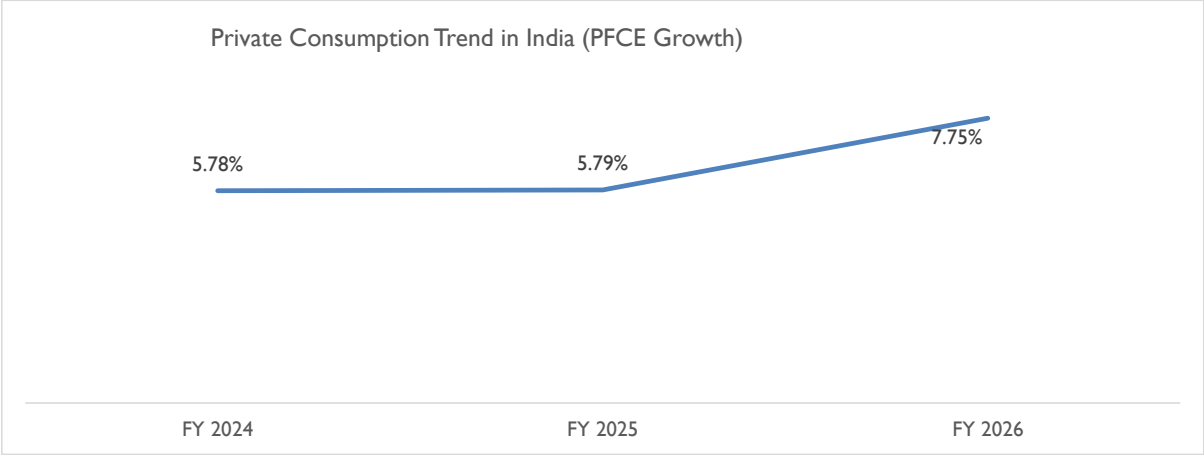
Source: Ministry of Statistics & Programme Implementation (MOSPI), CMIE Economics Outlook

On a quarterly basis, India's capital investment indicators reflect a healthy and improving investment environment, supported by sustained investment intensity and stronger capital formation in recent quarters. The Investment to GDP ratio remained consistently above 30% throughout the period, highlighting continued resilience in capital deployment. The ratio increased from 32.7% in Q1 FY 2024-25 to 34.7% in Q2, before moderating to 30.7% in Q3 and 30.9% in Q4. In FY 2025-26, the ratio improved again to 32.1% in Q1 and further strengthened to 34.8% in Q2, the highest level during the period, before remaining healthy at 30.8% in Q3 and 31.8% in Q4. This indicates that investment activity continued to remain robust despite normal quarterly variations.

GFCF (y-o-y) growth also points toward a positive investment trend, particularly in FY 2025-26. After remaining broadly stable during FY 2024-25, with growth ranging between 6.2% and 6.6%, GFCF growth accelerated meaningfully from 4.9% in Q1 FY 2025-26 to 8.4% in Q2 and 8.2% in Q3, before rising further to 10.8% in Q4. This strong improvement in the second half of FY 2025-26 suggests strengthening fixed capital formation and a revival in investment momentum. Overall, the data indicates that India's capital investment

landscape remains on a positive trajectory, with sustained investment levels and improving GFCF growth reflecting stronger capital spending, better investment confidence, and continued support for economic growth.

Private Consumption Scenario



Sources: MOSPI, CMIE Economics Outlook

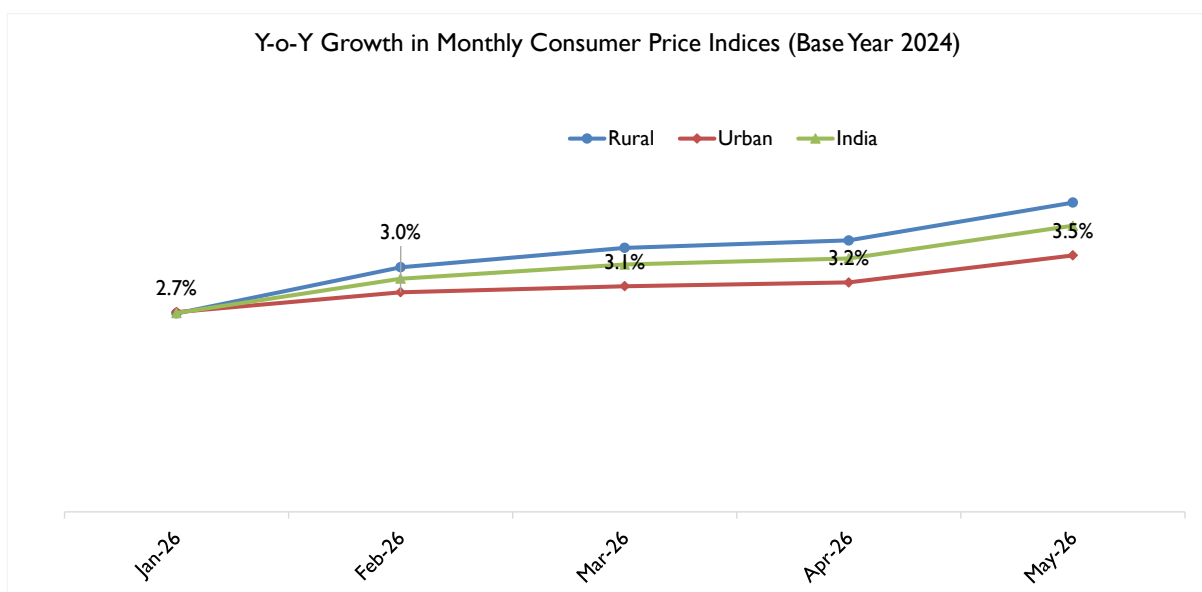
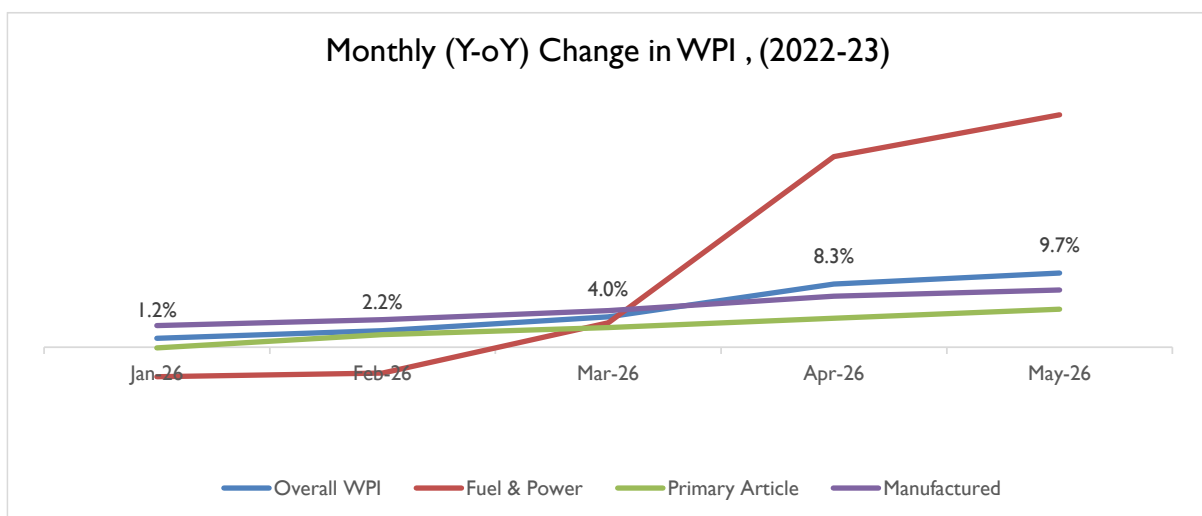
Private Final Consumption Expenditure (PFCE), a practical proxy for household spending, recorded growth in FY 2026 relative to FY 2025. PFCE recorded healthy growth in FY 2025-26 relative to FY 2024-25. However, quarterly PFCE growth moderated sequentially to 7.1% in Q4 FY 2025-26 from 8.2% in Q3 FY 2025-26

Inflation Scenario

The annual rate of inflation based on All India Wholesale Price Index (WPI) number is 3.88% (provisional) for the month of March 2026 (over March 2025). Positive rate of inflation in March 2026 is primarily due to increase in prices of crude petroleum & natural gas, other manufacturing, non-food articles, manufacture of basic metals and food articles etc.

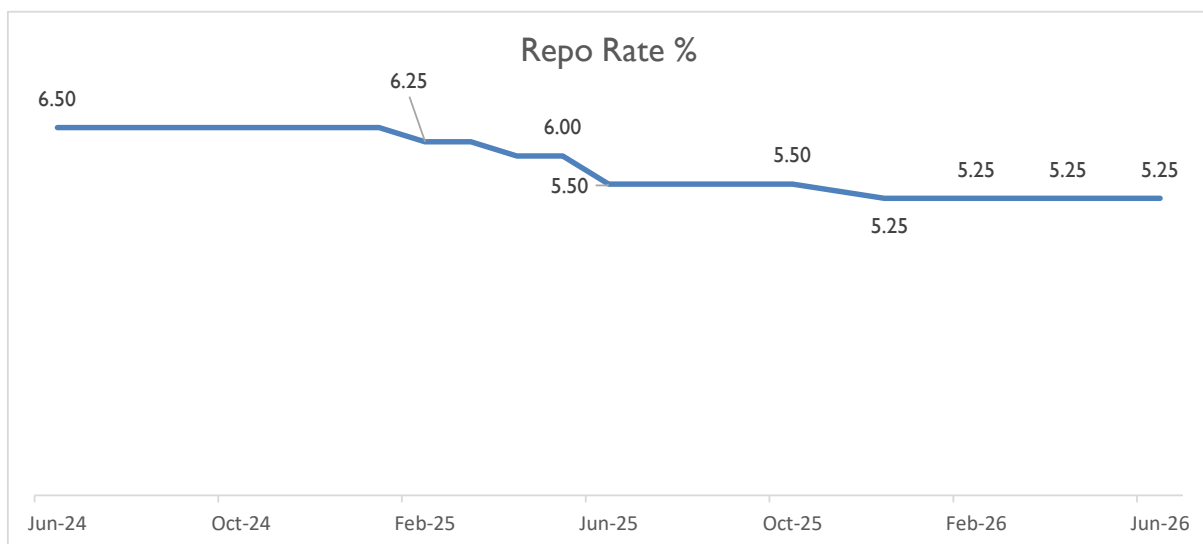
All India Wholesale Price Index (WPI) inflation for May 2026 is 9.68 per cent on year-on-year (YoY) basis, compared to 8.26 per cent in April 2026. The index for All Commodities for May 2026 stands at 109.9, whereas it was 108.8 in April 2026. Across Groups, 'Mineral Oils (containing Petroleum Products)', 'Crude Petroleum and Natural Gas', 'Manufacture of Chemicals and Chemical Products', and 'Manufacture of Basic Metals', have been major drivers of WPI inflation in April and May 2026.

Across Major Groups, YoY inflation for Primary Articles, Fuel and Power, and Manufactured Products is 4.99 per cent, 30.33 per cent, and 7.48 per cent, respectively in May 2026, whereas it was 3.78 per cent, 24.89 per cent, and 6.68 per cent, respectively, in April 2026. The indices for Primary Articles, Fuel and Power, and Manufactured Products are 113.7, 113, and 107.8, respectively, in May 2026, whereas they were 112.6, 110.9, and 107, respectively, in April 2026.



Source: MOSPI, Office of Economic Advisor

With effect from January 2026, the National Statistics Office (NSO) introduced a revised CPI series with base year 2024=100, drawing revised item weights from the Household Consumption Expenditure Survey (HCES) 2023-24. Year-on-year inflation rate based on All India Consumer Price Index (CPI) with base year 2024 for the month of May, 2026 over May, 2025 is 3.93%(Provisional). Corresponding inflation rates for rural and urban are 4.25% and 3.53%, respectively. On the monetary policy front, the RBI had cumulatively raised the repo rate by 250 basis points between May 2022 and February 2023, bringing it to 6.50%, where it was held steady through January 2025 to anchor inflationary expectations. With inflation moderating below target and growth requiring support, the RBI's Monetary Policy Committee (MPC) commenced an easing cycle in February 2025, delivering a cumulative 125 basis points of rate cuts through four reductions — 25 bps each in February 2025, April 2025, and December 2025, and a larger 50 bps cut in June 2025 — interspersed with pauses in August and October 2025. The repo rate currently stands at 5.25%, in June 2026.



Sources: CMIE Economic Outlook

Growth Outlook

The Union Budget 2026–27 sets out a quantitatively strong push to build resilient supply chains and develop next-generation industrial capacity. The record ₹12.2 trillion capital expenditure outlay is aimed at easing logistics bottlenecks and enhancing India's cost competitiveness. Employment measures extend across both urban and rural India in one sweep. In cities and large towns, capex is channelled into “connectors” such as the seven proposed high-speed rail corridors and upgraded Tier-2 and Tier-3 infrastructure, thereby creating construction, logistics, and service jobs while cutting commute times. In smaller towns and villages, job creation is expected to be supported by mega textile parks, the Mahatma Gandhi Gram Swaraj Initiative's push for khadi and handloom, training for tourist guides, and new waterways and coastal shipping. Together, these steps broaden the wage base instead of providing a short-term bump.

This domestic push is complemented by targeted measures to strengthen strategic supply chains. Dedicated rare earth corridors in Odisha, Kerala, Andhra Pradesh, and Tamil Nadu; customs exemptions for capital

goods used in critical mineral processing and battery cells; and the India Semiconductor Mission 2.0 aim to pull manufacturing deeper into components and materials. If executed well, these measures could reduce import dependence in magnets, batteries, and chip inputs and lift the share of higher-productivity manufacturing jobs — thereby raising household incomes durably.

Alongside these domestic measures, India is also seeking to strengthen its external trade architecture through major trade agreements. The conclusion of the India–EU FTA negotiation marks a major strategic milestone, as it offers near-universal market access for 99.5% of India’s exports by value and integrates India more deeply into a USD 24 trillion economic bloc. By providing duty-free entry for key labour-intensive sectors, expanding services access, and establishing a mobility framework for Indian professionals, the deal is expected to improve market access, support export competitiveness and high-value job creation. It is likely to promote a predictable, rules-based environment for long-term trade and investment flows.

In a similar vein, India–Oman Comprehensive Economic Partnership Agreement (CEPA)³ has been framed as a comprehensive arrangement covering trade in goods and services, investment, professional mobility, and regulatory cooperation, with the objective of strengthening bilateral economic integration between India and Oman. Bilateral trade between the two countries stood at USD 10.61 billion in FY 2024–25, providing the economic basis for the agreement. Under the CEPA, India has secured 100% duty-free market access in Oman across 98.08% of tariff lines, covering 99.38% of India’s export value, thereby improving export competitiveness across sectors such as engineering goods, pharmaceuticals, agriculture and processed food, electronics, textiles, plastics, and gems and jewellery. At the same time, India has adopted a calibrated liberalisation approach by offering tariff concessions on 77.79% of its tariff lines, covering 94.81% of imports from Oman by value, while retaining safeguards for sensitive domestic sectors. The agreement also provides gains in services, with Oman undertaking commitments across 127 services sub-sectors, alongside improved provisions for professional mobility, including an increase in the Intra-Corporate Transferee ceiling from 20% to 50% and commitments for a defined category of Indian professionals. Overall, the CEPA is presented as a framework intended to support trade expansion, improve market access, and strengthen long-term economic cooperation between India and Oman.

However, these gains remain exposed to external geopolitical risks. The escalation of the Middle East crisis represents an external shock for India, transmitted primarily through energy markets, logistics, and trade-linked business exposure. The Gulf–Levant 11⁴ (GL 11) economies account for around 15% of India’s merchandise exports and 21% of its imports, with trade concentrated in high-value categories such as mineral

³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2213203®=3&lang=1>

The Comprehensive Economic Partnership Agreement (CEPA) between India and Oman marks a meaningful step forward in the economic relationship between the two countries. The agreement brings together trade in goods and services, investment, professional mobility, and regulatory cooperation under a single, coherent framework aimed at deepening bilateral economic integration.

⁴ For the purposes of this report, the analysis is confined to a defined group of countries referred to as the Gulf–Levant 11 (GL-11). This group comprises Bahrain, Iran, Iraq, Israel Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. These economies are treated collectively because they are either directly involved in, or immediately exposed to, the current crisis through geographic proximity, security linkages, energy production and transit, or their role as regional trade and financial hubs

fuels, precious metals, and electronics; disruptions in this region therefore have an outsized impact despite its modest share of global GDP.

Export exposure is unevenly distributed across India, with risks concentrated in specific districts that serve as production hubs. Discretionary exporters, such as gems and jewellery firms in the districts of Surat, Jaipur, and Mumbai; apparel manufacturers in Tiruppur; automotive producers in Ahmedabad; and electronics assemblers in Kanchipuram and Kolar, are vulnerable to demand slowdown and order deferrals in Gulf markets.

At the same time, Perishable agricultural exporters, including grapes from Nashik, bananas from Solapur, and bovine meat from Ghaziabad, face acute risks from shipping delays and logistics disruptions. Dun & Bradstreet data show that over 4,500 Indian exporters and around 1,800 importers relied on the Strait of Hormuz trade route in 2025, exposing them to working capital stress, payment delays, and production interruptions, while, for import-dependent industries, delays in critical inputs raise the risk of temporary shutdowns and sustained energy price volatility amplifies margin pressure across manufacturing and services.

Key Growth/Demographic Drivers for Economic Growth

Government focus on infrastructure development

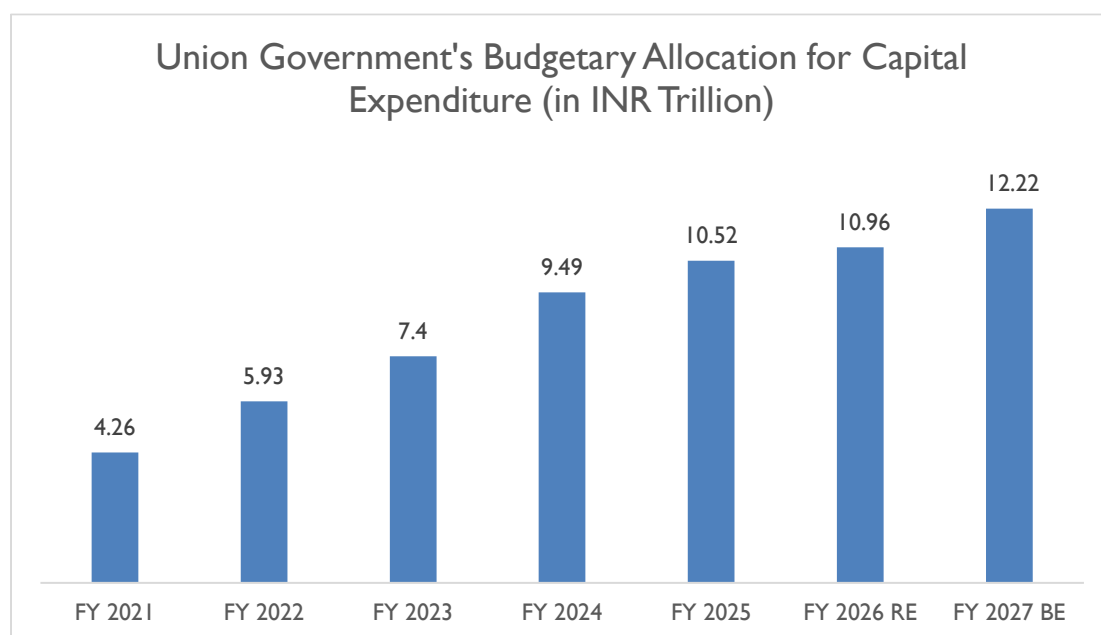
The infrastructure sector has received a strong boost in Budget FY'27, marked by a record INR 12.2 trn⁵ public capital expenditure allocation, reinforcing the government's focus on making assets more efficient and sustainable. The introduction of the landmark Infrastructure Risk Guarantee Fund aims to provide partial credit guarantees to lenders and revitalise private sector participation in large-scale projects. By lowering project risk premiums and easing borrowing costs, this mechanism is likely to help crowd in private capital and accelerate construction phase financing across the sector. The transport and logistics sector, in particular, will buoy infrastructure growth. Railways have received a substantial boost in allocation, which will help support the planned development of seven new high-speed rail corridors and a Dankuni-Surat DFC⁶, which aims to cut logistics costs and improve national connectivity. Moreover, the rollout of 20 new National Waterways, new ship repair hubs and a scheme to double the share of coastal and inland water transport from 6.0% to 12.0% by 2047⁷ will together build a greener, more efficient multimodal freight network. Urban transformation continues through targeted development of Tier-2 and Tier-3 cities – with populations over 0.5mn – alongside the creation of City Economic Regions, each supported by multi-year, challenge-based financing to establish new growth hubs and reduce pressure on metros. A broader ecosystem of reforms strengthens medium-term sector prospects. The government aims to scale domestic construction and infrastructure equipment manufacturing, reducing import dependence and improving execution capability in tunnelling, metro construction and road building machinery. The monetisation of CPSE assets will be accelerated through dedicated REIT⁸ structures, helping unlock liquidity for redevelopment and new project pipelines. Additional support flows through region-specific initiatives, such as industrial corridor expansion, and tourism development in cultural and Buddhist heritage zones will further reinforce construction demand. Together, these measures will strengthen India's infrastructure ecosystem through higher public investment, improved risk mitigation tools and wider multimodal connectivity – creating a constructive environment for sustained growth in construction, logistics and urban development.

⁵<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2222521®=3&lang=1#:~:text=Reinforcing%20the%20role%20of%20public,productive%20capacity%20across%20the%20economy.>

⁶ <https://prsindia.org/budgets/parliament/demand-for-grants-2026-27-analysis-railways>

⁷ https://www.indiabudget.gov.in/doc/budget_speech.pdf

⁸<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2221817®=3&lang=1>



Union Budget, Government of India
 Note: BE (Budget Estimates) and RE (Revised Estimates)

Development of Domestic Manufacturing Capability

The Government launched the Production Linked Incentive (PLI) scheme in early 2020, initially aimed at improving domestic manufacturing capability in large-scale electronic manufacturing and gradually extended to other sectors. At present it covers 14 sectors, ranging from medical devices to solar PV modules. The PLI scheme provides incentives to companies on incremental sales of products manufactured in India. This incentive structure is aimed at attracting private investment into setting up manufacturing units and thereby strengthening domestic production capabilities. The overall incentive outlay earmarked for the PLI scheme is estimated to be INR 2 trillion. If fully realised, the PLI scheme could add nearly 4% to annual GDP growth, by way of incremental revenue generated from the newly formed manufacturing units.

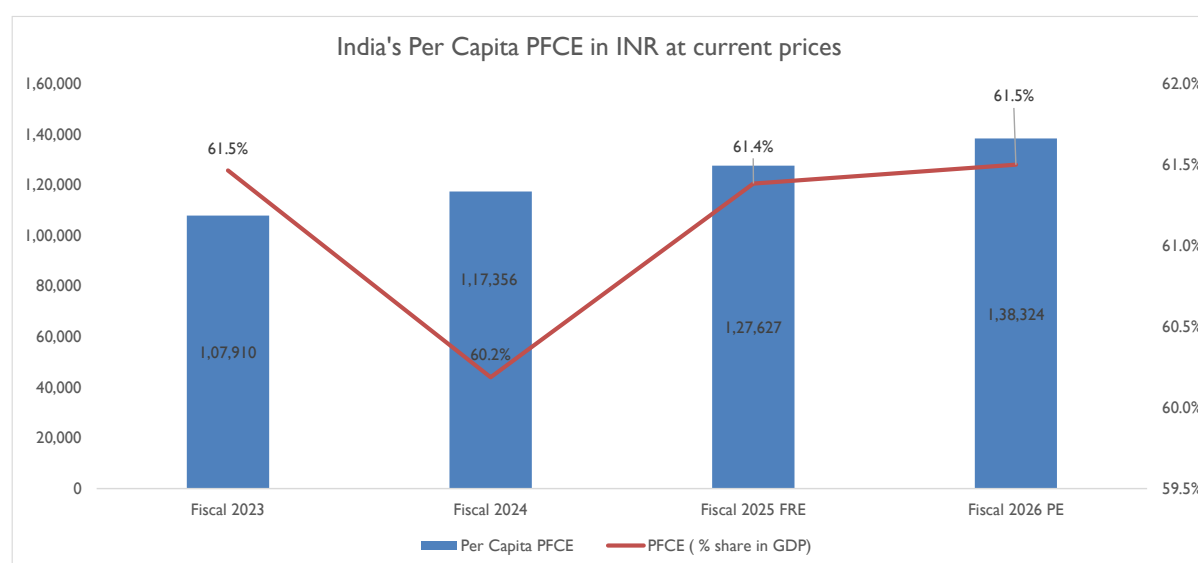
Strong Domestic Demand

Domestic demand has traditionally been one of the key drivers of the Indian economy. After a brief lull caused by the Covid-19, domestic demand is recovering. Consumer Confidence surveys by the Reserve Bank and other institutions point to an improvement in the Consumer Confidence Index, which is a precursor of improving demand. India has a strong middle-class segment, which has been the major driver of domestic demand. Factors like fast paced urbanization and improving income scenario in rural markets are expected to accelerate domestic demand further. This revival is reflecting in the private final consumption expenditure (PFCE) metric.

India's per capita Private Final Consumption Expenditure (PFCE) at current prices has shown a consistent upward trend, indicating steady improvement in household consumption levels over the years. Per capita PFCE increased from INR 1,07,910 in Fiscal 2023 to INR 1,17,356 in Fiscal 2024, and further rose to INR 1,27,627

in Fiscal 2025 FRE. It is estimated to increase further to INR 1,38,324 in Fiscal 2026 FE, reflecting continued growth in consumer spending and improving consumption capacity.

PFCE as a share of GDP also remained healthy during the period, broadly staying above 60%. The share stood at 61.5% in Fiscal 2023, moderated to 60.2% in Fiscal 2024, before recovering to 61.4% in Fiscal 2025 FRE and further improving to 61.5% in Fiscal 2026 FE. This indicates that private consumption continues to remain a key driver of India's economic growth. Overall, the steady increase in per capita PFCE, along with a stable PFCE share in GDP, reflects resilient household demand and sustained consumption momentum in the economy.



Source: Ministry of Statistics & Programme Implementation (MOSPI)

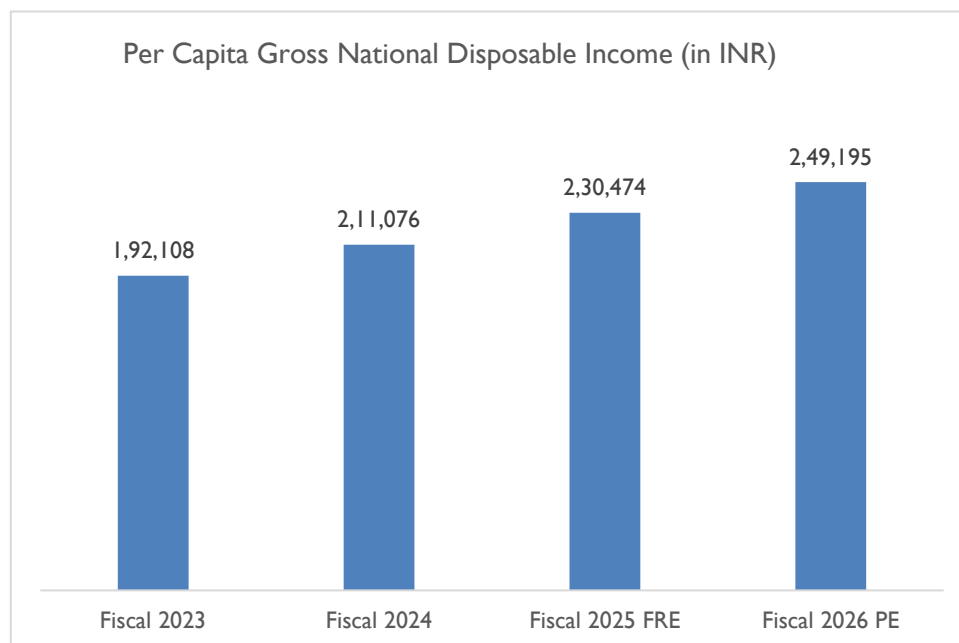
FRE is First Revised Estimate; PE is Provisional Estimates

There are two factors driving this domestic demand: first, the large pool of consumers; and second, the improvement in purchasing power.

- The share of middle class increased from nearly 14% in 2005 to nearly 30% in 2021 and is expected to cross 60% by 2047⁹. This expanding middle class household segment is fuelling India's growth story and would continue to play a key role in propelling India's economic growth.
- Consumer-driven domestic demand is majorly fuelled by this growth in per capita income. As per National Statistics Office (NSO), India's per capita Gross National Disposable Income (GNDI) has shown a steady upward trend, reflecting improvement in overall income levels and disposable income capacity. Per capita GNDI increased from INR 1,92,108 in Fiscal 2023 to INR 2,11,076 in Fiscal 2024 and further rose to INR 2,30,474 in Fiscal 2025 FRE. It is estimated to increase further to INR 2,49,195 in Fiscal 2026 PE, indicating continued growth in income levels across the economy. The consistent

⁹ As per the survey conducted by People Research on India's Consumer Economy. Households with annual income in the range of INR 5 – 30 lakhs are considered as middle-class households.

rise in per capita GNDI highlights strengthening purchasing power and improving household income conditions, which can support consumption demand going forward. Overall, the trend reflects a positive income environment, with rising disposable income expected to contribute to sustained private consumption and broader economic growth.



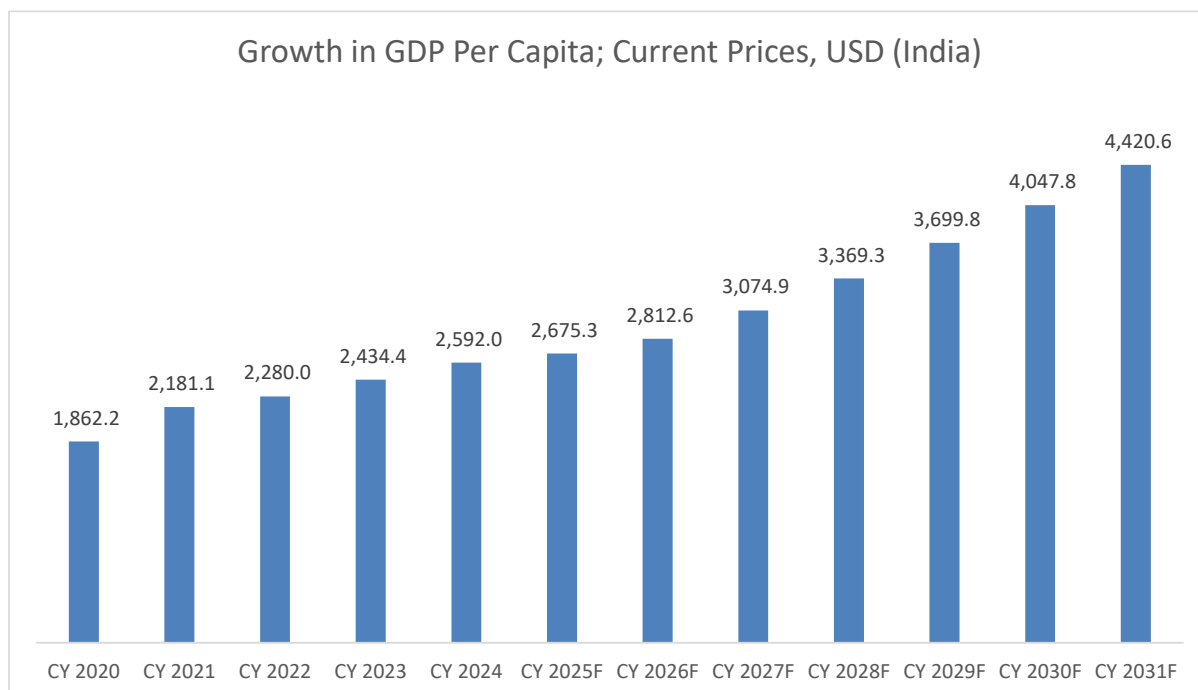
Source: Ministry of Statistics & Programme Implementation (MOSPI)

FRE is First Revised Estimate; PE is Provisional Estimates

India's Per Capita GDP Trends

India is poised to become the world's third-largest economy with a projected GDP of USD 5 trillion within the next three years, driven by ongoing reforms. As one of the fastest-growing major economies, India currently holds the position of the fifth-largest economy globally, following the US, China, Japan, and Germany. By 2027-28, it is anticipated that India will surpass both Germany and Japan, reaching the third-largest spot. This growth is bolstered by a surge in foreign investments and a wave of new trade agreements with India's burgeoning market of 1.4 billion people. The aviation industry is witnessing unprecedented orders, global electronics manufacturers are expanding their production capabilities, and suppliers traditionally concentrated in southern China's manufacturing hubs are now shifting towards India.

To achieve its vision of becoming the world's third-largest economy by 2027-28, India will need to implement transformative industrial and governmental policies. These policies will be crucial for sustaining the consistent growth of the nation's per capita GDP over the long term.

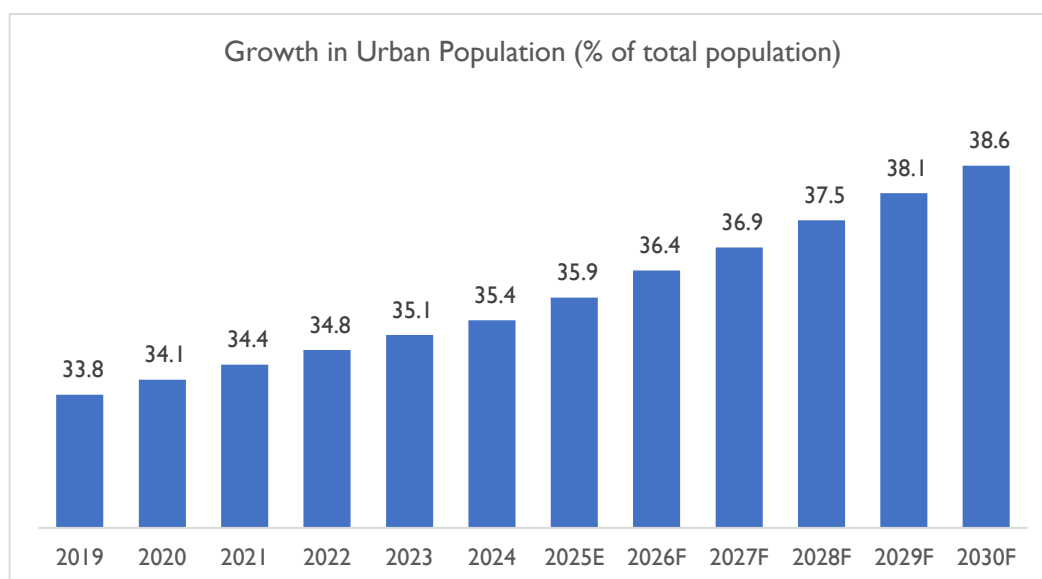


Source: IMF

From CY 2024 to CY 2031, India's per capita GDP is projected to grow at a compound annual growth rate of 7.9%. This growth will be driven by the service sector, which now accounts for over 50% of India's GDP, marking a significant shift from agriculture to services.

Increasing Urbanization

As per the Handbook of Urban Statistics 2022, India's urban population has been on a steady rise. Urban dwellers accounted for over 469 million in 2021 and are projected to rise to over 558 million by 2031 and further exceed 600 million by 2036.



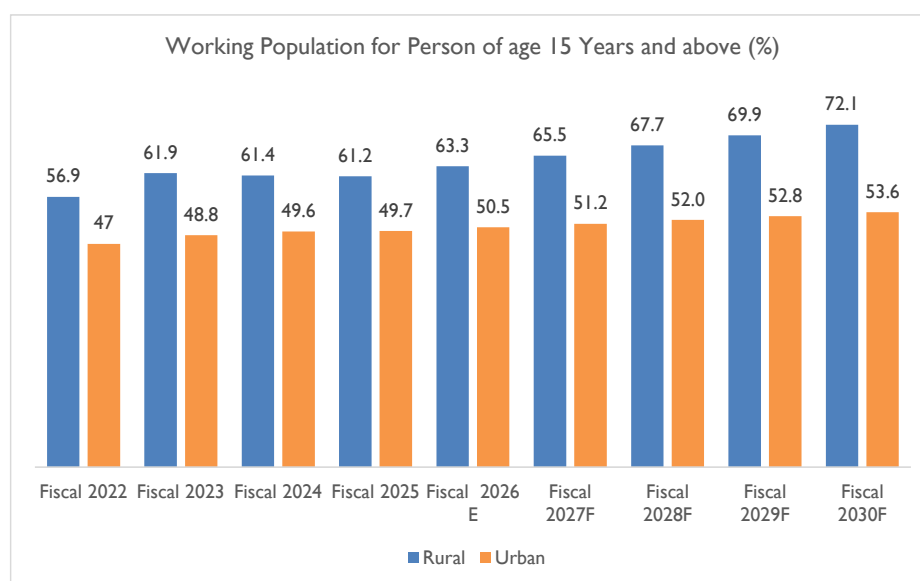
Source: World Bank,¹⁰ Dun & Bradstreet Research and Estimates

¹⁰<https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2022&locations=IN&skipRedirection=true&start=1960&view=chart>

The share of urban population in total population has been rising steadily. In 2019, 33.81% of the total population was urban. By 2025, it had reached 35.9%, showing an increase over a span of five years of about 2.10%. The share of urban population is further forecasted to cross 38.6% by 2030. This increase in urban population is set to demand drastic changes in infrastructure development. Cities are a major driver for the construction industry. With cities expanding rapidly, there will be an increased need for improved housing, water supply, sewage systems, and electricity. Urban planning will need to account for higher population densities, necessitating the development of smart cities with integrated technology for efficient management of resources and services. The Smart Cities Mission targeted at 100 cities is aimed at improving the quality of life through modernised, technology-driven urban planning. This transformation will also require significant investment in public health, education, and recreational facilities to enhance the quality of urban living. The surge in urban population will also propel demand for improvement in multimodal transport infrastructure for freight and passenger travel requirements.

Rural vs. Urban Working Population by Age Group

As India continues to experience economic growth and development, the working population in both rural and urban areas is increasing. In the case of the urban population, this growth is reflected in the increase from a share of 47% in FY22 to 49.7% in FY25, whereas in rural areas, it grew from 56.9% in FY22 to 61.2% in FY25. This growth is driven by a combination of factors, including demographic changes, economic policies, and the expansion of various industries. The rise in employment opportunities across sectors such as agriculture, manufacturing, services, and information technology has contributed to the overall increase in the working population, thereby fostering economic stability and enhancing the standard of living for many Indians.



Source: Periodic Labour Force Survey (PLFS) Annual Report, Dun & Bradstreet Research and Estimates

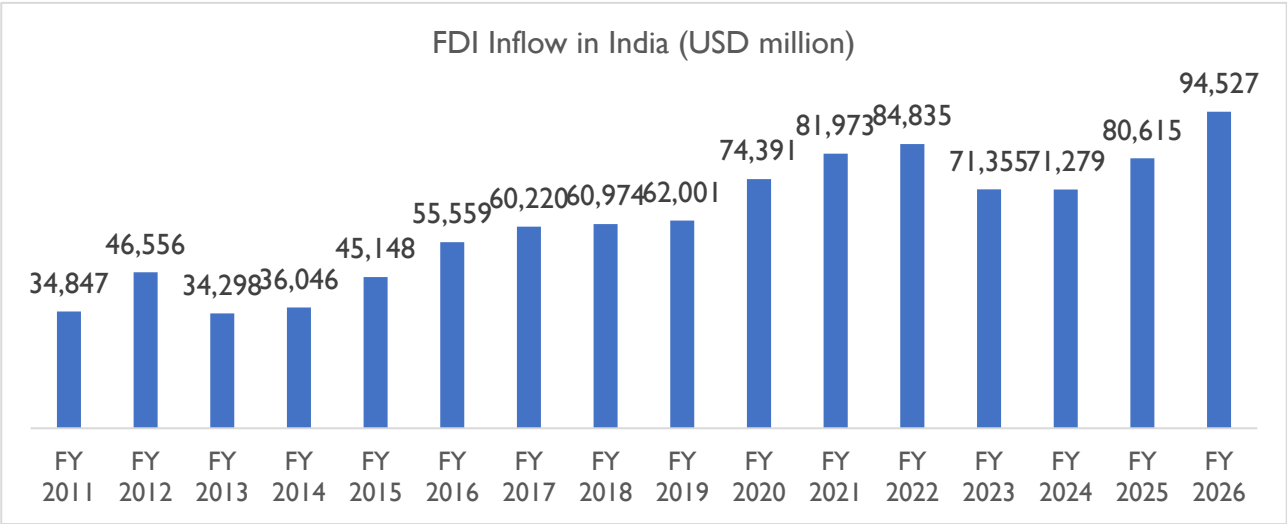
Note: 2025 refers to the period January 2025 – December 2025 and likewise for 2024, 2023 and 2022

In urban areas, the working population is growing rapidly due to the proliferation of jobs in sectors like IT, finance, retail, and healthcare. Additionally, the development of infrastructure, such as improved transportation networks and housing, has made urban centers more accessible and desirable for the working population. In rural areas, the working population remains substantial, primarily due to the dominance of the agricultural sector. Government initiatives aimed at rural development, such as improved access to education and skill development programs, have also played a crucial role in enhancing employment prospects in these regions.

The dominance of the rural working population over its urban counterpart can be attributed to the labour-intensive nature of the agricultural sector, which ensures a consistent demand for human labor despite advancements in mechanization, sustaining employment rates in rural areas.

Foreign Direct Investment Trend in India

FDI inflows in India observed a steady increase from FY 2013 to FY 2022 while it witnessed a decline of 15% in FY 2023 and a decline of 0.1% in FY 2024 due to several factors, including the ongoing conflict between Russia and Ukraine, changes in US monetary policy, and other global uncertainties. However, the country has received substantial FDI inflows from April 2000 to March 2026. This increasing FDI can be attributed to the new investment facilitation measures like the National Single-Window System (NSWS), which streamlines the approval and clearance process for investors, entrepreneurs, and businesses, along with sectoral measures and PLI schemes, supporting growth prospects in tier-2 and tier-3 cities. Further, tax compliance for startups and foreign investors has been simplified and the Income Tax Act, 1961, was amended in 2024 to abolish angel tax and to reduce income tax rate chargeable on income of a foreign company.



Sources: Department for Promotion of Industry and Internal Trade

Product Overview Railway Sleepers and MS Pipes

Railway sleepers and mild steel (MS) pipes are two vital building blocks of infrastructure that directly support transport, logistics, and industrial development. Railway sleepers form the foundation of rail track systems, ensuring stability, safety, and durability of passenger and freight operations. On the other hand, MS pipes play an equally crucial role in enabling water supply, energy transmission, construction frameworks, and engineering applications, making them indispensable across multiple sectors of the economy.

The railway sleeper industry has seen a marked transition toward prestressed concrete sleepers, which offer superior load-bearing strength, longer service life, and lower maintenance compared to traditional wooden or steel alternatives. Their application spans high-speed rail corridors, metro networks, freight corridors, and industrial railways each requiring durability and resistance to environmental stress. The steady expansion of India's railway network, coupled with track doubling and modernization programs, ensures consistent demand for concrete sleepers as part of ongoing and future infrastructure projects.

MS pipes, in contrast, are characterized by their versatility and adaptability across end-use industries. Their use ranges from urban water pipelines and rural irrigation to pumping storage and hydro mechanical projects. With rapid urbanization, government-led infrastructure projects, and industrial expansion, demand for MS pipes continues to grow both in India and globally. The sector benefits from relatively low production costs and scalability, allowing it to meet diverse needs from basic utility pipelines to high-specification industrial applications.

Together, railway sleepers and MS pipes represent two critical yet complementary segments of infrastructure development. While sleepers ensure the reliability and safety of rail transport the backbone of logistics MS pipes provide the skeletal framework for utilities and construction. Their growth trajectories reflect larger themes of modernization, urban expansion, and industrialization, making them central to national and global infrastructure strategies.

Railway Sleepers

Railway sleepers, also known as railroad ties or cross-ties, are a fundamental component of railway track infrastructure. Placed beneath the rails, they hold the correct gauge, transfer loads from trains to the track bed, and ensure stability and safety of railway operations. Depending on regional practices and performance requirements, railway sleepers are manufactured from **wood, concrete, steel, and plastic composites** each material type offering distinct benefits and limitations.

Wooden Sleepers

Wooden sleepers are the most traditional type and continue to dominate in North America, where they account for about 93% of installed railway ties. They are typically manufactured from hardwoods such as oak, jarrah, and karri, or from softwoods like Douglas fir.

Wooden sleepers are lightweight, easy to transport and install, and more affordable in terms of upfront cost. They can be applied to nearly all railway track sections and, after decommissioning, can be reused in landscaping or fencing. However, their major limitations include a shorter service life, susceptibility to humidity and weather conditions, and difficulties in recycling, which makes them less cost-effective over time.

Concrete Sleepers

Concrete sleepers, primarily made of pre-stressed concrete, are widely used in high-speed and heavy-load railway lines. This technology introduces internal tension to the sleeper before casting, which strengthens it against external stresses. First introduced in France and popularized after World War II, concrete sleepers are now extensively used in Asia, Europe, and Australia.

They are more durable, with a lifespan of 40–50 years, offer excellent stability due to their heavier weight, and require less maintenance. While they are cost-effective in the long run, their high weight makes handling and installation more challenging, and their application is limited in certain areas such as bridges and crossings.

Steel Sleepers

Steel sleepers are formed by pressing steel into a trough-like shape with rail fastening housings welded on top. They represent a balance between wood and concrete, being stronger than wood yet more economical than concrete.

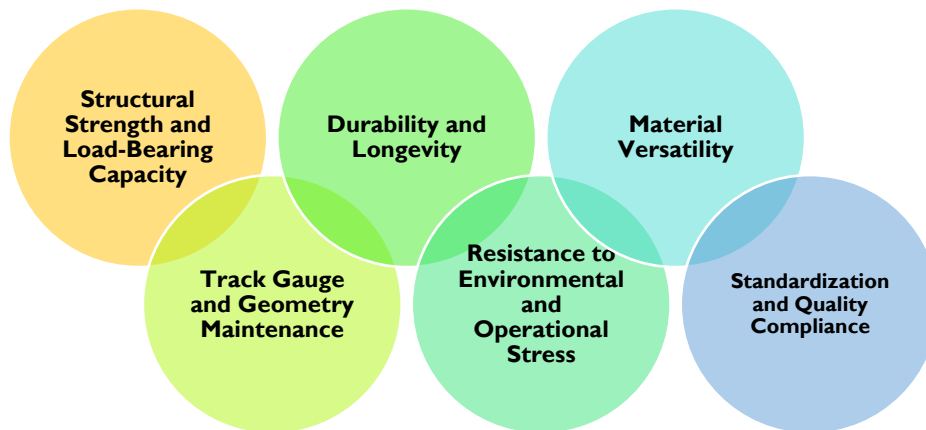
Although not as widely used, steel sleepers find applications in specific conditions, such as secondary railway lines in the UK and desert railways like the Hejaz Railway, where wooden sleepers were often stolen for firewood. Steel sleepers are durable, recyclable, lightweight, and easy to install. However, they are vulnerable to corrosion, require higher maintenance, and face limitations in application due to insulation challenges.

Plastic (Composite) Sleepers

Plastic sleepers, also called composite sleepers, are modern innovations made from a mixture of recycled plastics and waste rubber. They combine the flexibility of wood with the durability of concrete, while also addressing the sustainability challenges of other materials.

Plastic sleepers were first applied in Japan and later installed in Austria on the Zollamt Bridge in Vienna. These sleepers are environmentally friendly, recyclable, and long-lasting, with service lives ranging between 30 to 80 years. They are lightweight, easy to install, and effective in reducing track vibrations. Despite these benefits, their relatively high production cost has limited their large-scale adoption.

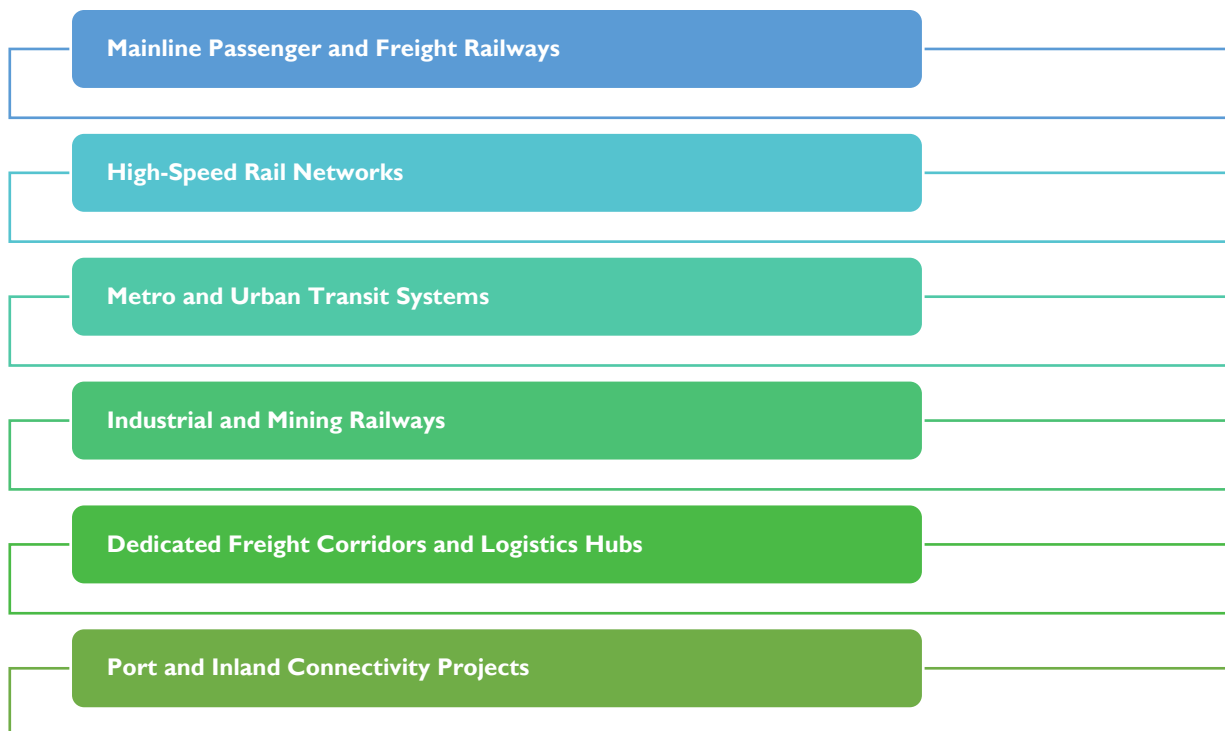
Key Features, Applications, and End-Use Industries



- **Structural Strength and Load-Bearing Capacity:** Railway sleepers are designed to withstand immense dynamic loads transferred from the train wheels through the rails. Their core function is to distribute these loads evenly to the ballast and subgrade, preventing localized stress points that could damage the track foundation. High structural strength ensures stability even under heavy axle loads, such as in freight and high-speed rail systems. This load-bearing attribute makes sleepers indispensable for safe and reliable rail operations.
- **Durability and Longevity:** A defining feature of modern railway sleepers, particularly concrete and composite variants, is their long service life. Unlike traditional wooden sleepers that degrade under weather exposure, pests, or moisture, advanced materials are designed to last decades with minimal maintenance. Their durability reduces the frequency of replacements and track downtime, which is vital for large railway networks handling continuous traffic. This feature enhances operational efficiency while lowering long-term lifecycle costs.
- **Material Versatility:** Sleeper's today is available in multiple material types wood, prestressed concrete, steel, and composites. Each material brings unique benefits, with wooden sleepers offering flexibility in curves, concrete delivering high strength and uniformity, and composites providing resistance to corrosion and environmental wear. This versatility allows railway authorities to select sleeper types tailored to specific operational needs and environments, whether for heavy-haul corridors, high-speed lines, or metro systems.
- **Track Gauge and Geometry Maintenance:** A key attribute of sleepers is their role in maintaining the correct spacing of rails, known as gauge, and ensuring alignment of the track geometry. They anchor the rails firmly, resisting movement caused by train-induced forces, thermal expansion, and vibrations. Proper gauge maintenance directly impacts passenger safety and ride comfort while minimizing derailment risks. This precision role makes sleepers a fundamental component in both conventional and modern rail systems.

- **Resistance to Environmental and Operational Stress:** Modern railway sleepers are engineered to withstand environmental challenges such as extreme temperatures, heavy rainfall, chemical exposure, and biological degradation. Concrete and composite sleepers, in particular, offer resistance to rot, termites, and fire, making them suitable for diverse geographical regions. Additionally, they are designed to endure continuous vibrations, braking forces, and acceleration loads without significant deterioration. This resistance ensures reliability across varied terrain and climatic conditions.
- **Standardization and Quality Compliance:** Sleepers are manufactured according to stringent standards set by railway authorities to ensure uniformity, safety, and interoperability. Prestressed concrete sleepers, for instance, follow specifications on dimensions, reinforcement, and load tests to ensure consistent quality across large-scale production. This standardization facilitates mass procurement by national railways while enabling easy replacement and compatibility across different rail networks. Compliance with standards also guarantees global acceptance for export markets.

Key- End Use Applications:



➤ **Mainline Passenger and Freight Railways:**

The most extensive application of railway sleepers is in mainline railways, which form the backbone of national transport networks. Sleepers in this segment must handle high volumes of both passenger and freight traffic, ensuring stability and safety over long distances. Concrete and steel sleepers are preferred here due to their ability to support heavy axle loads and provide longevity. By maintaining rail alignment under continuous use, they enable smooth operations of express trains and freight corridors.

➤ **High-Speed Rail Networks:**

Sleepers are crucial in high-speed rail systems, where precision and stability are non-negotiable. At speeds exceeding 200 km/h, even slight deviations in rail geometry can lead to safety risks or passenger discomfort. Prestressed concrete sleepers are commonly used in such networks because of their superior strength and ability to maintain track integrity under dynamic forces. Their role in reducing vibrations and ensuring minimal deflection makes them indispensable in the growth of high-speed corridors in countries like India, Japan, and China.

➤ **Metro and Urban Transit Systems:**

Urban metro systems, light rail, and monorails rely heavily on sleepers to provide track stability in densely populated city environments. These systems demand low-maintenance, durable solutions due to the high frequency of trains and limited downtime for track repairs. Concrete and composite sleepers are widely adopted in metro projects because they offer long service life and resistance to environmental stresses. Their application supports the rapid expansion of urban mobility solutions aimed at reducing congestion and pollution.

➤ **Industrial and Mining Railways:**

Railway sleepers also play a vital role in industrial and mining railways, which transport raw materials such as coal, iron ore, and cement. These operations require sleepers that can endure extremely heavy loads, harsh weather conditions, and corrosive environments. Steel and heavy-duty concrete sleepers are often chosen for such settings due to their resilience and minimal maintenance requirements. By supporting uninterrupted transport of materials, sleepers contribute directly to the efficiency of mining and industrial supply chains.

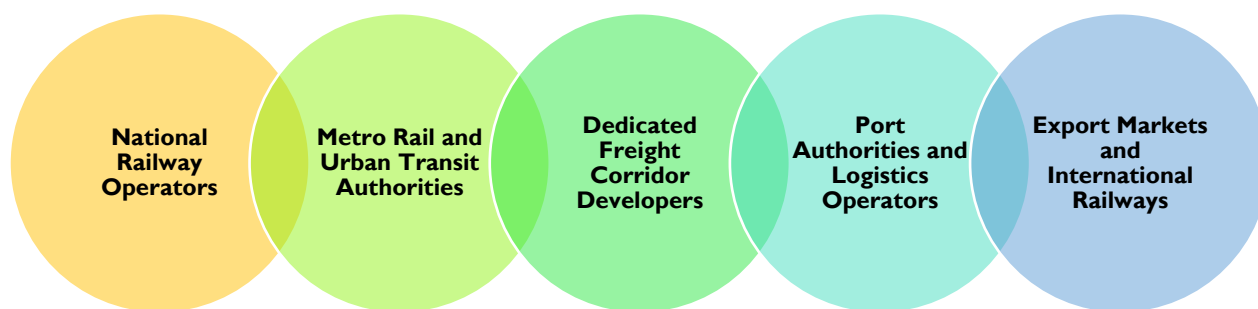
➤ **Dedicated Freight Corridors and Logistics Hubs:**

With the rise of dedicated freight corridors (DFCs) and integrated logistics hubs, demand for sleepers has surged in freight-specific rail infrastructure. These tracks are designed for high-capacity freight trains that operate at higher speeds than traditional cargo services. Concrete sleepers with specialized designs are widely used here to handle the stress of frequent heavy haul traffic. Their application ensures timely cargo movement, reduced congestion on passenger lines, and improved supply chain efficiency.

➤ **Port and Inland Connectivity Projects:**

Another growing application is in port rail networks and inland container depots, where sleepers are installed to support efficient cargo movement. These facilities demand robust sleepers capable of handling continuous freight loading and unloading operations. Composite sleepers are also finding use here due to their durability and resistance to moisture and chemical exposure. Their role in strengthening port connectivity is critical for boosting international trade and supporting multimodal logistics systems.

Major end use industries /customer segments:



➤ **National Railway Operators**

The largest customer segment for railway sleepers is national railway authorities, such as Indian Railways, which oversee the bulk of passenger and freight transport across the country. These operators procure millions of Pre-Stressed Concrete (PSC) sleepers annually for new track construction, network expansion, and replacement of old assets. Their procurement decisions often set benchmarks for technical specifications and quality standards across the industry. As government-backed entities, their demand is consistent and directly linked to national infrastructure development priorities.

➤ **Metro Rail and Urban Transit Authorities**

With the rapid growth of urbanization, metro rail corporations and city transit agencies are emerging as key buyers of railway sleepers. Projects in cities like Delhi, Mumbai, Bengaluru, and Hyderabad require durable and low-maintenance sleepers that can sustain high train frequency. This segment favors concrete and composite sleepers, which provide superior longevity in high-traffic environments. Urban transit demand is expected to grow further as smart cities and rapid mobility solutions expand across India.

➤ **Dedicated Freight Corridor Developers**

With India investing heavily in Dedicated Freight Corridors (DFCs) and specialized logistics rail networks, freight operators and infrastructure developers represent a growing customer base. These corridors prioritize efficiency and speed for goods movement, requiring sleepers that can handle frequent heavy haul traffic. Concrete sleepers with advanced designs are typically procured for these projects to ensure long-term performance. This segment will see rapid growth in demand as freight corridors expand nationwide.

➤ **Port Authorities and Logistics Operators**

Ports and inland container depots are increasingly investing in railway infrastructure to strengthen multimodal connectivity. Port authorities procure sleepers for rail lines within port terminals to facilitate container movement, while logistics operators install them in freight yards and depots. Concrete sleepers are gaining traction in these environments due to their resistance to moisture, salinity, and chemical exposure. This customer segment is vital for improving global trade competitiveness and supply chain efficiency.

➤ Export Markets and International Railways

Beyond domestic demand, sleeper manufacturers also cater to export markets, supplying to railways in Africa, the Middle East, and Southeast Asia. Many of these countries are upgrading or expanding their networks and seek cost-effective and reliable sleeper solutions. Indian manufacturers, supported by competitive pricing and standardized quality, have built strong export potential. This customer segment adds diversification to demand and positions Indian suppliers in the global railway supply chain.

Precast Concrete Industry: Scenario, Manufacturing Process, Product Types, and Applications

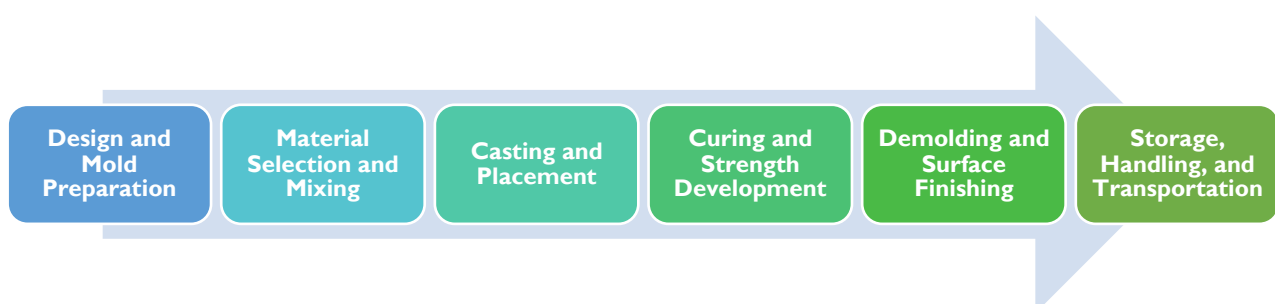
The precast concrete industry has become an integral part of the modern construction ecosystem, offering solutions that combine speed, precision, and durability. Unlike traditional cast-in-situ construction, precast products are manufactured in controlled environments, ensuring consistent quality and reduced dependence on on-site labor. This method has gained traction in recent years as governments and private developers seek faster project delivery without compromising safety or structural integrity.

In India, the industry is witnessing strong growth driven by infrastructure development programs, including metro rail projects, highways, bridges, affordable housing, and smart city initiatives. Government policies encouraging urban renewal and industrial development have further boosted demand for precast products such as sleepers, pipes, girders, and boundary walls. The adoption of precast technology is also aligned with the Make in India and sustainability agenda, as it reduces wastage, enhances recyclability, and minimizes environmental impact.

Globally, the industry is expanding due to rising urbanization, industrialization, and demand for resilient infrastructure. Developed economies have already adopted precast concrete as a standard practice, while emerging markets like India, Southeast Asia, and Africa are increasingly turning to it to meet infrastructure backlogs. The sector is also benefitting from technological advances such as automated production lines, modular construction, and innovative materials, which enhance efficiency and reduce lifecycle costs.

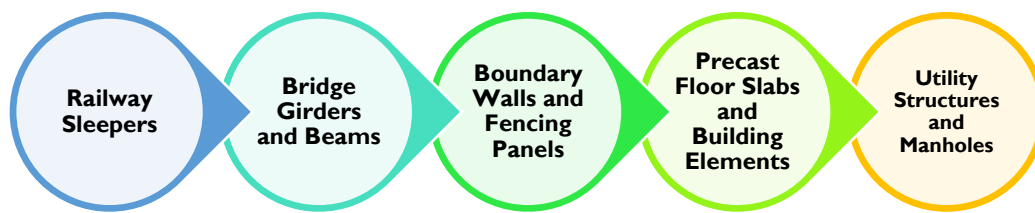
Overall, the precast concrete industry is positioned as a future-ready enabler of construction, offering scalable solutions for sectors ranging from transport and logistics to housing and urban development. Its industry scenario is defined by a shift towards faster, greener, and smarter construction practices, ensuring it remains a critical driver of infrastructure growth in the years ahead.

Manufacturing Process Overview:



- **Design and Mold Preparation:** The process begins with detailed design based on the specifications of the required component, such as sleepers, pipes, or girders. Precision-engineered steel or fiberglass moulds are then prepared to shape the concrete accurately. These moulds ensure uniformity across batches and allow for customization according to project requirements. Proper mould preparation, including cleaning and application of release agents, is critical for achieving smooth surfaces and defect-free products.
- **Material Selection and Mixing:** High-quality raw materials such as cement, aggregates, sand, water, and admixtures are carefully selected to meet strength and durability requirements. These materials are batched in precise proportions and mixed using automated batching plants to ensure consistency. Admixtures like plasticizers or retarders are added to improve workability, setting time, and final strength. Controlled mixing minimizes variability and helps in producing components with predictable performance.
- **Casting and Placement:** Once the concrete mix is ready, it is poured into molds under controlled conditions. For products requiring reinforcement, steel bars or prestressing tendons are positioned within the mold before pouring. The mix is compacted using vibration techniques to eliminate air pockets and ensure uniform density. Careful placement of concrete is crucial to avoid segregation and to maintain structural integrity across the entire component.
- **Curing and Strength Development:** After casting, the precast elements are cured to facilitate hydration and strength gain. Steam curing or accelerated curing methods are often employed to speed up the process while ensuring desired durability. Curing conditions are carefully monitored to prevent cracking, shrinkage, or uneven strength development. This stage ensures that the precast units achieve the required mechanical properties before demolding and transportation.
- **Demoulding and Surface Finishing:** Once the curing cycle is complete, the hardened components are safely removed from the moulds. At this stage, surface finishing processes such as grinding, polishing, or coating may be applied depending on the intended use. Quality checks are carried out to ensure dimensional accuracy, structural strength, and defect-free surfaces. Proper finishing not only enhances appearance but also improves durability and resistance to external elements.
- **Storage, Handling, and Transportation:** The final stage involves careful storage of precast components in designated yards before dispatch. Specialized equipment and lifting tools are used to handle the heavy units without causing damage. Components are then transported to construction sites using trucks or trailers, often with logistical planning for just-in-time delivery. This step ensures the precast elements are ready for quick installation, minimizing delays and optimizing project timelines.

Types of Precast Concrete Products:



➤ **Railway Sleepers**

Precast railway sleepers are one of the most critical applications of precast concrete, widely used by railways for track stability and load distribution. Prestressed concrete sleepers are preferred over timber or steel because of their strength, durability, and ability to handle heavy axle loads. They ensure consistent track gauge, resist vibrations, and offer long service life with low maintenance. With large-scale railway expansion and modernization projects, sleepers remain a high-demand product in the precast segment.

➤ **Bridge Girders and Beams**

Large precast elements such as I-girders, T-girders, and box girders are commonly used in highway flyovers, metro viaducts, and railway bridges. These components are prestressed for higher load-carrying capacity and are manufactured in controlled environments to achieve precision and durability. Precast girders significantly reduce on-site construction time, which is vital for time-sensitive projects. Their application supports faster rollout of metro rail corridors and expressway projects across India.

➤ **Boundary Walls and Fencing Panels**

Precast concrete boundary walls and panels are increasingly popular in residential, industrial, and institutional projects. They offer durability, uniform finish, and faster installation compared to traditional brick or masonry walls. These products are customizable in terms of height, texture, and design, providing both security and aesthetics. Their demand is rising due to urbanization and the need for cost-effective enclosure solutions in cities and industrial estates.

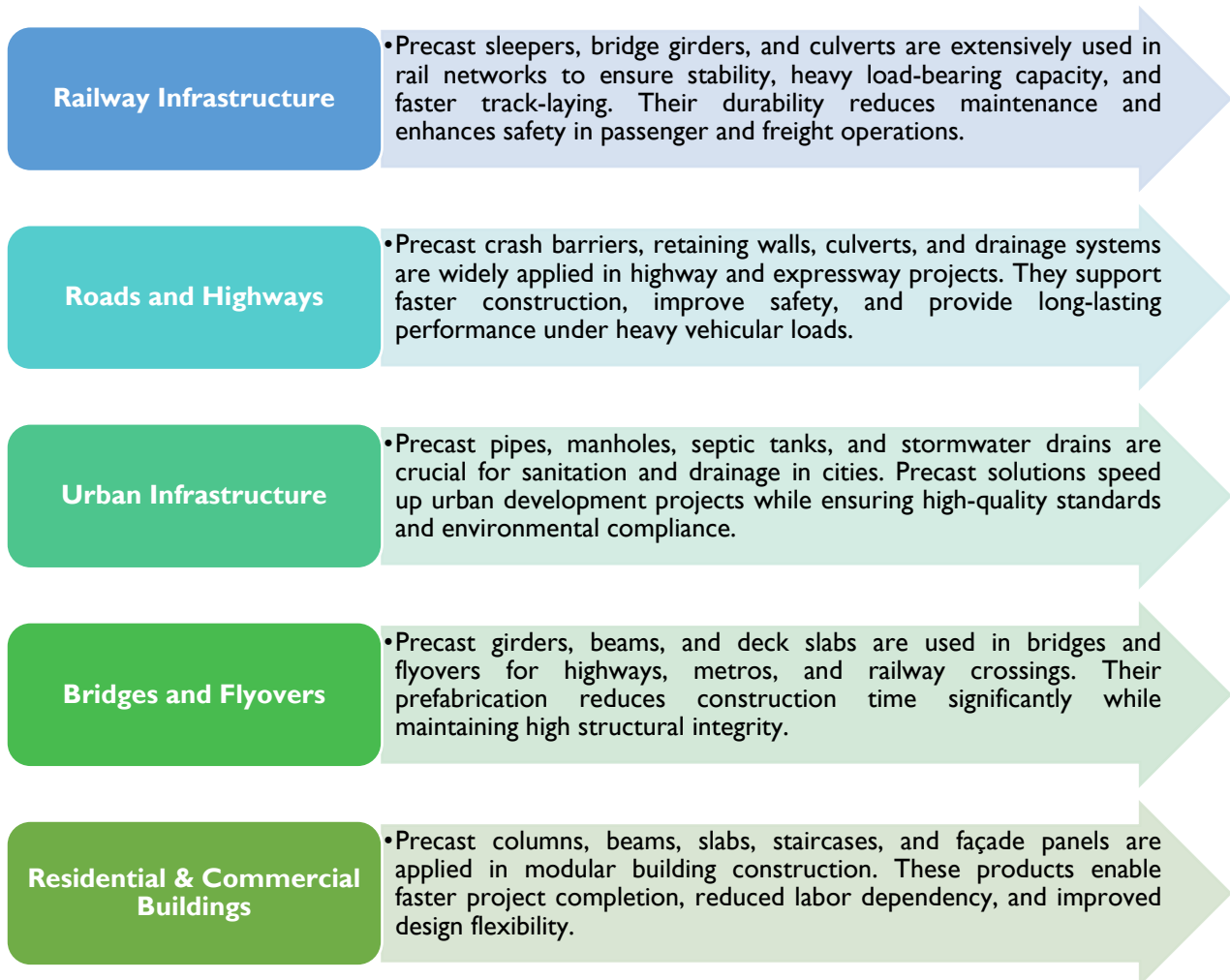
➤ **Precast Floor Slabs and Building Elements**

Products such as hollow core slabs, precast columns, beams, staircases, and façade panels are widely used in residential and commercial construction. These components allow modular and faster construction of multi-story buildings, reducing labor requirements and project timelines. Hollow core slabs, in particular, provide strength with reduced material usage, contributing to cost efficiency. By enabling standardized building designs, these products are transforming modern construction practices.

➤ Utility Structures and Manholes

Precast manholes, septic tanks, utility chambers, and inspection chambers are essential components of urban infrastructure. They are designed for quick installation, watertight performance, and resistance to heavy loads from vehicular traffic. These structures are widely deployed in underground cabling, stormwater systems, and sanitation projects. Their ease of maintenance and long service life make them a preferred choice for municipalities and utility providers.

Key Application Areas:



Raw Materials Utilized in Manufacturing Railway Concrete Sleepers

- **Cement:** Cement acts as the primary binding agent in sleeper production, typically Ordinary Portland Cement (OPC) or Portland Pozzolana Cement (PPC). Its quality determines the compressive strength and durability of the sleeper. Since sleepers are exposed to varying weather conditions, cement ensures resistance to moisture, temperature fluctuations, and chemical action. Consistent cement quality is crucial for long service life and structural stability.
- **Aggregates (Coarse & Fine):** Coarse aggregates like crushed granite or gravel, and fine aggregates like river sand, form the bulk of the sleeper. They provide rigidity, abrasion resistance, and dimensional stability under dynamic rail loading. Proper grading and cleanliness of aggregates ensure dense packing and reduced voids. This contributes to higher strength and minimizes risks of cracking under repeated stress.
- **Water:** Potable water free from harmful salts, oils, or organic impurities is essential for mixing and curing. The water-to-cement ratio plays a key role in ensuring optimum hydration, which directly influences strength and durability. Excess water can weaken the concrete, while insufficient water causes incomplete hydration. Controlled water usage ensures long-term sleeper performance.
- **Steel Reinforcement (Prestressed Wires / Tendons):** High-tensile steel wires or tendons are embedded to form pre-stressed concrete sleepers. They counteract tensile stresses caused by heavy loads and rail vibrations, preventing cracks. Prestressing improves structural integrity, allowing sleepers to carry higher axle loads without deformation. This makes reinforced concrete sleepers far more durable than wooden or steel alternatives.
- **Admixtures (Optional):** Admixtures like plasticizers and superplasticizers are often used to improve workability and reduce water demand. They help achieve higher strength, better compaction, and reduced permeability. Air-entraining agents may also be added to improve freeze-thaw resistance. The controlled use of admixtures tailor's sleeper performance to specific environmental and operational needs.

Application Areas of Railway Concrete Sleepers

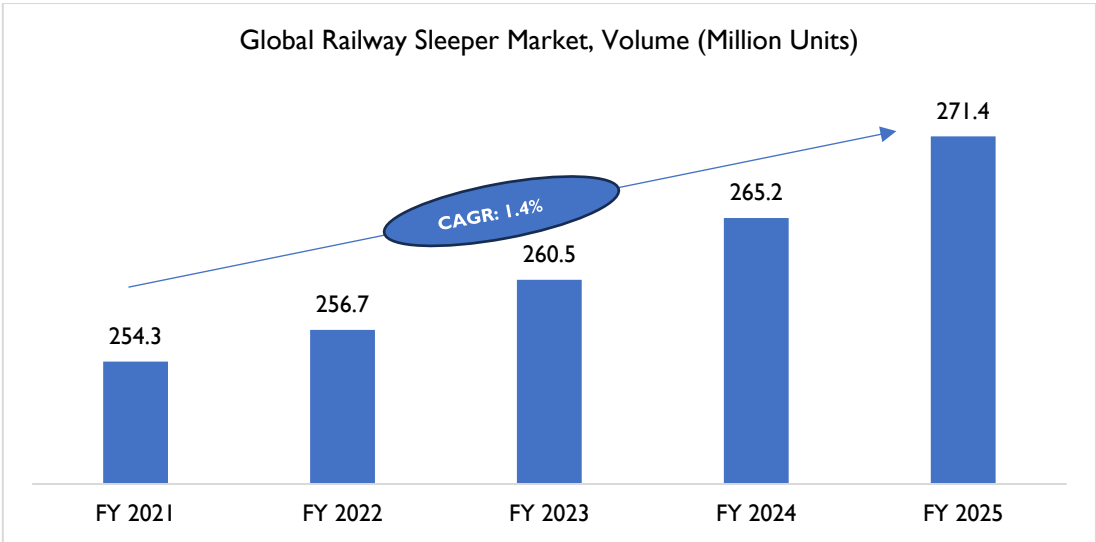
- **Mainline Tracks:** Concrete sleepers are extensively used on mainline tracks where trains operate at high speeds and carry heavy loads. They provide excellent stability and distribute wheel loads effectively, reducing stress on the ballast. Their durability ensures lower maintenance compared to wooden or steel sleepers. This makes them the standard choice for national and regional railway networks.

- **Metro & Urban Rail:** In metro rail and urban transport systems, concrete sleepers are preferred for their vibration-dampening properties. They help reduce noise and vibrations in densely populated areas, enhancing passenger comfort. Their longevity and low maintenance make them suitable for high-frequency train operations. Urban planners choose them to ensure sustainability in long-term infrastructure.
- **High-Speed Rail Corridors:** For bullet trains and high-speed rail lines, concrete sleepers provide the required dimensional precision and stability. They withstand dynamic forces generated by trains running at very high speeds. Their ability to maintain alignment reduces safety risks and ensures smooth operations. As a result, they are integral to India's and other countries' high-speed rail projects.
- **Bridges & Transition Zones:** Concrete sleepers are used on bridges and adjoining transition zones where track stability is critical. They resist vibrations, provide even load transfer, and reduce the risk of structural fatigue in bridges. Their robust construction minimizes maintenance demands in difficult-to-access areas. This ensures long-term safety and reliability of railway infrastructure.
- **Tunnels & Underground Sections:** In tunnels, concrete sleepers offer superior durability and require less frequent replacement, which is crucial in confined spaces. They provide strong support and help maintain track geometry under high pressure and vibration. Their resistance to fire and moisture makes them particularly suitable for underground operations. This ensures uninterrupted train movement with **reduced downtime**.
- **Industrial & Freight Railways:** Heavy freight lines in mining, steel, and port industries require sleepers that can handle extreme axle loads. Concrete sleepers provide the required strength and fatigue resistance in such demanding environments. They also withstand the abrasive action of freight wagons better than wooden alternatives. Their longevity reduces operational disruptions in critical industrial corridors.
- **Special Tracks (Turnouts & Crossings):** Custom-designed concrete sleepers are used for railway switches, crossings, and sharp curves. These areas experience complex load dynamics, making reinforcement essential. Concrete sleepers offer stability and resist deformation under such variable forces. Their use enhances safety and ensures smoother transitions across intricate railway layouts

Global Sleepers Market scenario

Annual demand volume & historical growth trends

The global railway sleeper market demonstrates steady growth momentum, with annual demand rising from **254.3 million units in FY 2021** to an estimated **271.4 million units in FY 2025**. This represents a modest but stable CAGR of **1.4%**, underscoring the consistent role of sleepers in railway infrastructure expansion and modernization worldwide.

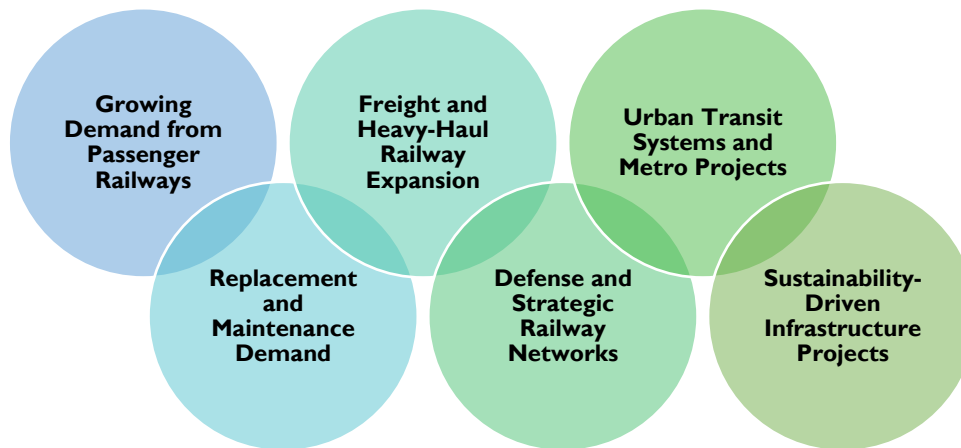


Source: D&B Insight Based on Primary Research

The incremental growth highlights how railway development projects, both in emerging and developed economies, continue to drive steady demand. While the pace of expansion is not rapid, it reflects a mature market where demand is closely tied to long-term infrastructure planning, maintenance, and replacement cycles. Countries with large-scale electrification and high-speed rail projects are particularly sustaining demand for concrete sleepers, which are increasingly preferred for their durability and load-bearing capacity.

From an industry perspective, this growth trend aligns with government-driven investments in rail modernization, urban transit networks, and freight corridors. The relatively moderate CAGR suggests that while new installations are contributing, a significant portion of the demand comes from **replacement of ageing tracks and sleepers**. This creates stable market conditions, making the sector less volatile and more predictable compared to other railway components.

Major demand trend from key user segments



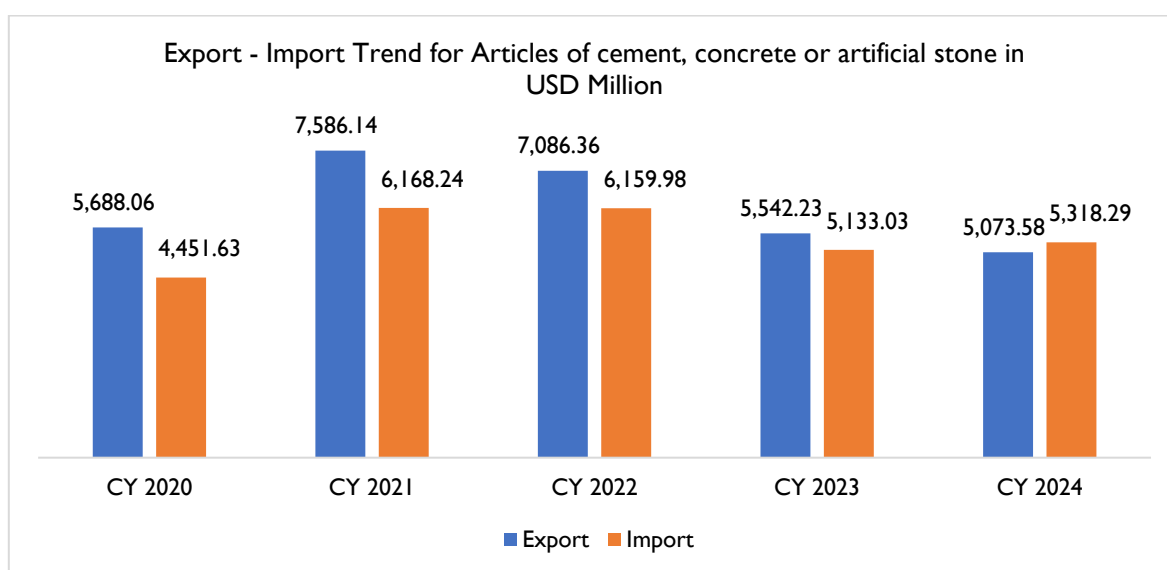
- **Growing Demand from Passenger Railways:** Passenger railway infrastructure is expanding rapidly, especially in Asia-Pacific and parts of Europe, driven by urbanization and government investment in high-speed rail. Concrete sleepers are preferred in these projects due to their durability, lower maintenance requirements, and ability to withstand heavy loads at high speeds. The rising focus on modern, efficient, and safe passenger transport systems is fueling consistent demand. Countries like China, India, and Japan are leading in adopting high-speed rail, while European nations are upgrading legacy systems. This sustained expansion is creating a strong pipeline for concrete sleeper deployment.
- **Freight and Heavy-Haul Railway Expansion:** The demand for freight corridors and heavy-haul railways is another critical driver of sleeper requirements. With global trade and commodity transport increasing, countries are enhancing their bulk logistics capabilities, particularly for coal, iron ore, and agricultural goods. Heavy-haul railways require sleepers that can withstand extreme loads and provide stability over long distances, making pre-stressed concrete sleepers a preferred choice. Markets like North America, Russia, and Australia are investing in heavy freight corridors, which directly translates into higher sleeper demand. This segment provides long-term growth, especially as economies pivot towards efficient freight transport to cut logistics costs.
- **Urban Transit Systems and Metro Projects:** Urban transit systems, metros, and suburban railways represent one of the fastest-growing demand areas. Rapid urbanization and population growth in megacities have made metro systems indispensable for managing urban mobility. Metro projects typically use concrete sleepers due to their high load-bearing capacity, vibration resistance, and long-life cycle. Countries like India, Indonesia, and Middle Eastern nations are launching large-scale metro projects, while Europe and North America continue to expand and modernize urban transit networks. This segment ensures sustained, localized demand, with significant scope for sleeper suppliers to align with smart-city development goals.

- **Replacement and Maintenance Demand:** Beyond new projects, the replacement cycle for existing sleepers is a major source of consistent demand. Wooden sleepers, still in use in several countries, are gradually being replaced by concrete and composite alternatives due to better performance and longer service life. Additionally, aging infrastructure in developed markets like the US and Europe necessitates regular maintenance and replacement cycles to ensure safety and efficiency. This ongoing replacement demand creates a stable baseline market, reducing reliance solely on new construction projects. It also highlights opportunities for advanced sleeper technologies with enhanced durability and sustainability credentials.
- **Defense and Strategic Railway Networks:** Military logistics and strategic railway lines are emerging as specialized demand areas for sleepers. Nations with large defense logistics networks, such as Russia, China, and India, are investing in resilient railway infrastructure capable of supporting troop movement, heavy equipment, and rapid deployment. These defense-focused projects demand high-strength, durable sleepers capable of performing under adverse conditions, such as extreme climates and remote terrains. Furthermore, sleeper demand in this segment often involves stringent quality and performance specifications, creating opportunities for suppliers to deliver advanced, custom-engineered solutions. The niche yet critical nature of this demand ensures steady opportunities in strategic markets.
- **Sustainability-Driven Infrastructure Projects:** Sustainability considerations are reshaping sleeper demand globally. Governments and operators are prioritizing low-carbon, eco-friendly infrastructure solutions. Concrete sleepers, being recyclable and longer-lasting than wood, align well with these goals. In addition, new materials such as composite sleepers made from recycled plastics and fibers are gaining traction in markets where environmental regulations are stricter, such as Europe and North America. The global transition toward green infrastructure is expected to further drive the adoption of modern sleeper technologies, with suppliers increasingly innovating to balance performance, cost, and sustainability.

Global trade scenario

Historical Export and Import Trend

The export-import trend for articles of cement, concrete, or artificial stone reflects significant fluctuations over the period CY 2020–CY 2024. Exports peaked in CY 2021 at USD 7,586.14 million, while imports were at USD 6,168.24 million, indicating strong international demand for these materials. However, from CY 2022 onward, both exports and imports declined, with exports falling to USD 5,073.58 million and imports slightly higher at USD 5,318.29 million in CY 2024, marking a shift where imports have overtaken exports. This transition highlights a weakening trade surplus and a growing reliance on foreign supply.



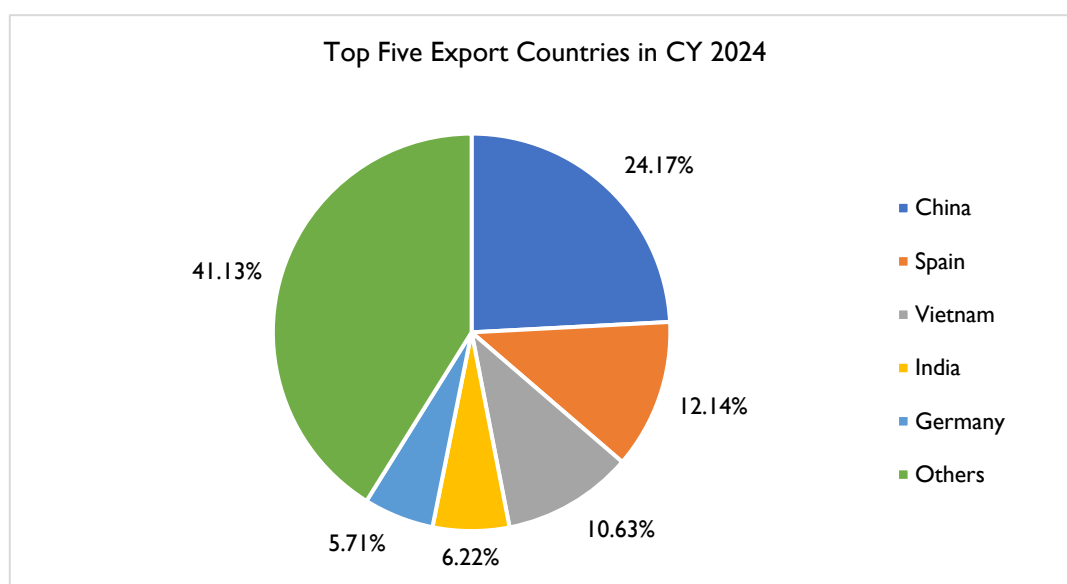
Source ¹¹: International Trade Centre

The trend suggests that while India initially enjoyed a strong position as a net exporter, competitive pressures, rising domestic costs, and increasing dependence on specialized imports have altered the trade dynamics. The narrowing gap between exports and imports, culminating in an import surplus in CY 2024, indicates both a possible saturation of export markets and a structural demand for higher-quality or niche cement-based products not produced locally. This could also be linked to domestic infrastructure policies that encouraged imports to meet quality and time-bound project requirements.

From the perspective of **railway infrastructure**, especially railway sleepers, the trend is significant. Railway sleepers, often made of concrete for durability, directly consume cement and concrete articles. The increase in imports suggests that domestic production may not be keeping pace with demand, particularly in large-scale infrastructure projects such as railways, where uniform quality and supply consistency are crucial. The reliance on imports in CY 2024 aligns with India's railway capex push, as the need for precast concrete sleepers has risen with network expansion, electrification, and modernization initiatives.

¹¹ HS Code – 681099 (Articles of cement, concrete or artificial stone, whether or not reinforced (excl. prefabricated structural components for building or civil engineering, tiles, paving, bricks and the like))

Insight on Top five exporting countries



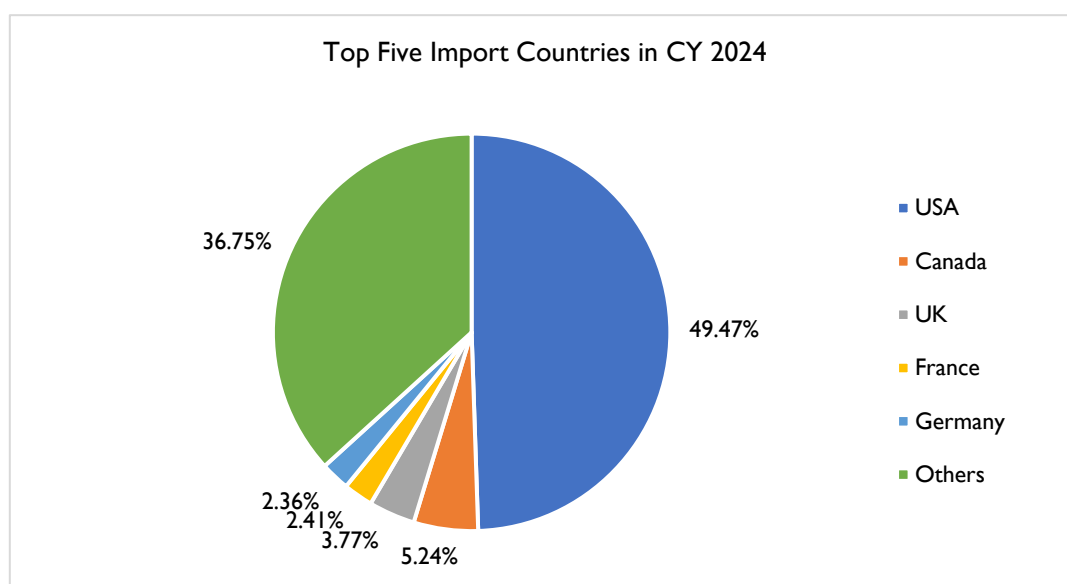
Source ¹²: International Trade Centre

In CY 2024, exports of articles of cement, concrete, or artificial stone (excluding prefabricated structural components) were led by **China at USD 1,226.14 million (24.17%)**, followed by **Spain (USD 615.92 million, 12.14%)**, **Vietnam (USD 539.33 million, 10.63%)**, **India (USD 315.75 million, 6.22%)**, and **Germany (USD 289.80 million, 5.71%)**. Together, these top five countries accounted for nearly **59%** of global exports, while the “Others” group contributed **USD 2,086.65 million (41.13%)**. This distribution highlights China’s leadership in cost-effective large-scale production, Europe’s strong role through Spain and Germany, and the increasing importance of emerging Asian economies like Vietnam and India in supplying global markets.

With respect to **railway sleepers**, this pattern is closely tied to infrastructure capabilities and material availability. China’s dominance reflects both its massive domestic concrete industry and its position as a leading supplier for Belt and Road Initiative (BRI) projects, where concrete sleepers are in high demand. Spain and Germany, with advanced railway technology, export high-quality and specialized sleepers to support international projects, especially in Europe, Latin America, and Africa. Vietnam and India are strengthening their roles as cost-competitive exporters, catering to markets in Southeast Asia, Africa, and the Middle East where railway expansion is accelerating. The Others category underscores a diversified supplier base, with multiple countries exporting to niche or regional projects, indicating a healthy global supply chain for concrete sleepers.

¹² HS Code – 681099 (Articles of cement, concrete or artificial stone, whether or not reinforced (excl. prefabricated structural components for building or civil engineering, tiles, paving, bricks and the like)

Insight on Top five importing countries



Source ¹³: International Trade Centre

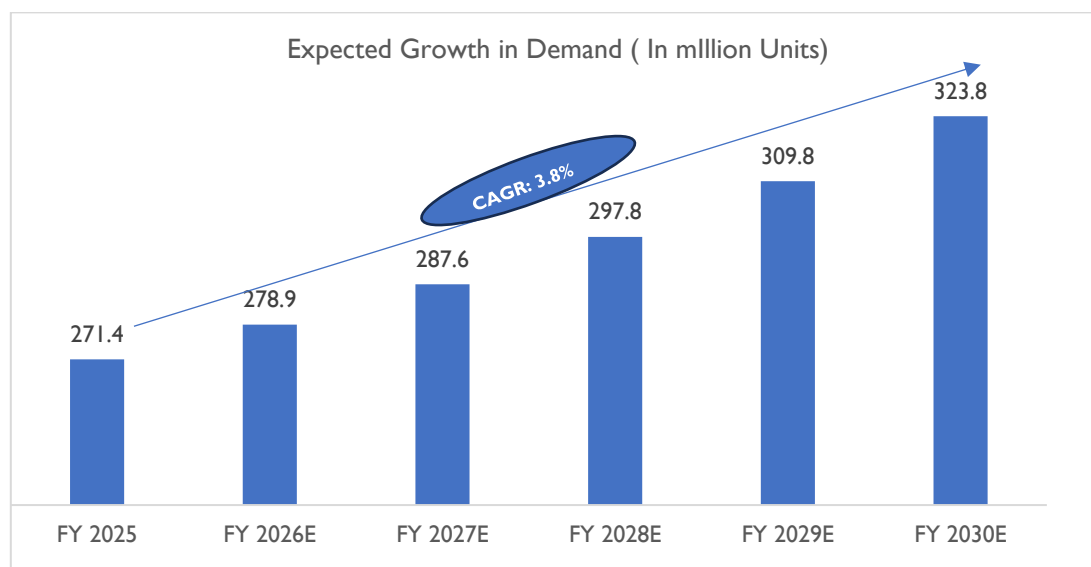
In CY 2024, global exports of articles of cement, concrete, or artificial stone (excluding prefabricated structural components) were led by the **USA at USD 2,631.04 million (49.47%)**, followed by **Canada (USD 278.58 million, 5.24%)**, the **UK (USD 200.63 million, 3.77%)**, **France (USD 128.12 million, 2.41%)**, and **Germany (USD 125.68 million, 2.36%)**. Together, these five countries accounted for more than 63% of global exports, while “Others” contributed **USD 1,954.25 million (36.75%)**. This distribution indicates a strong concentration of export capability in developed economies, underpinned by advanced production technology, adherence to global quality standards, and established trade networks.

With respect to **railway sleepers**, this export pattern reflects the role of concrete-based products in supporting infrastructure expansion worldwide. The USA’s dominance is linked to its large-scale production of prestressed concrete sleepers that cater to global demand, especially in countries undertaking railway modernization. Canada, the UK, France, and Germany also act as specialized suppliers to international rail projects, particularly in Europe and emerging markets. Meanwhile, the substantial “Others” category highlights diversified sourcing from Asia-Pacific and the Middle East, where domestic railway development projects increasingly rely on imports to bridge supply gaps. The data underscores how leading economies are not only meeting their own infrastructure needs but also acting as primary suppliers of concrete sleepers to fast-growing global railway markets.

¹³ HS Code – 681099 (Articles of cement, concrete or artificial stone, whether or not reinforced (excl. prefabricated structural components for building or civil engineering, tiles, paving, bricks and the like)

Growth forecast: Expected growth in demand (next 3 – 5 years)

The railway sleeper market is expected to grow steadily from **271.4 million units in FY 2025** to **323.8 million units in FY 2030E**, reflecting a CAGR of **3.8%**. This trajectory shows a sharper growth compared to historical trends, driven by accelerated railway infrastructure development, capacity expansion, and modernization projects across key geographies.



Source: D&B Insight Based on Primary Research

The incremental rise of over **52 million units** during this period highlights strong demand not only from new network additions but also from the replacement of aging sleepers. Countries investing in **high-speed rail corridors, freight modernization, and urban transit networks** are anticipated to be the primary demand drivers. Additionally, the push for concrete and composite sleepers over traditional wooden variants is reinforcing market expansion, given their higher durability and lower lifecycle costs.

Overall, the forecast signals a sustained and predictable growth outlook, supported by government capex commitments, public-private investments, and ongoing replacement needs. This positions the sleeper industry as a critical enabler of global railway transformation, ensuring resilience and stability in demand through 2030.

Evolving factor shaping the industry growth in future

The global sleeper's industry is undergoing significant transformation, driven by technological innovation, infrastructure expansion, and sustainability imperatives. With governments prioritizing railways as a backbone of sustainable transport, demand is evolving beyond traditional applications into high-speed, urban transit, and eco-friendly projects. Future growth will be shaped not only by rising investments but also by changing material preferences, lifecycle efficiency considerations, and regulatory pressures for greener infrastructure.

➤ **Shift Toward High-Speed Rail Development**

High-speed rail projects are increasingly becoming the centrepiece of national infrastructure strategies, particularly in Asia-Pacific and Europe. These projects demand advanced, durable sleepers that can handle higher dynamic loads and ensure stability at speeds above 250 km/h. Governments are investing heavily in intercity connectivity, reducing travel times, and cutting emissions through rail-based transport. As more countries adopt high-speed rail networks, suppliers will need to adapt their designs and manufacturing standards accordingly. This trend ensures a sustained pipeline of technologically advanced sleeper demand in the long term.

➤ **Technological Advancements in Sleeper Materials**

The industry is witnessing innovation in sleeper materials, shifting from traditional wood and steel to concrete and composite alternatives. Composite sleepers, often made from recycled plastics and fibers, are gaining acceptance in markets focused on sustainability. These materials offer advantages such as resistance to moisture, rot, and pests while providing longer service life with minimal maintenance. The push for environmentally friendly solutions is accelerating R&D in sleeper manufacturing. This evolution is expected to redefine cost structures, performance standards, and market competition in the coming years.

➤ **Government Infrastructure Investments and Policies**

Public sector investments and policy support remain key drivers of sleeper industry growth. National governments are allocating significant budgets for expanding and upgrading railway infrastructure, particularly under long-term development plans and climate-focused transport goals. For instance, stimulus packages post-economic downturns often prioritize rail as a sustainable transport option. Additionally, international funding agencies are supporting large-scale rail projects in developing economies. This policy-driven momentum ensures that sleeper demand is tied not only to market forces but also to long-term national infrastructure strategies.

➤ **Emphasis on Lifecycle Cost and Maintenance Efficiency**

Railway operators and governments are increasingly considering lifecycle costs rather than upfront expenses. Concrete and composite sleepers, with their longer durability and reduced maintenance requirements, are becoming the preferred choice over traditional alternatives. This shift aligns with the industry's focus on minimizing disruptions, lowering operating costs, and ensuring safety over decades. Suppliers that can demonstrate performance improvements and cost savings across the entire lifecycle of sleepers will remain competitive. The emphasis on durability and efficiency is pushing manufacturers to enhance product innovation.

➤ **Urbanization and Metro Rail Expansion**

The rise of urban populations is fuelling the expansion of metro rail and urban transit projects worldwide. With cities seeking to reduce congestion and carbon emissions, metro systems are increasingly prioritized in infrastructure budgets. Metro projects demand sleepers designed for tight curves, frequent load variations, and vibration absorption in densely populated areas. This segment offers steady and localized growth opportunities for sleeper suppliers. As urbanization continues, especially in Asia, Africa, and Latin America, metro projects will remain a strong growth engine for the industry.

➤ **Sustainability and Circular Economy Pressure**

Sustainability is no longer optional; it is becoming central to infrastructure procurement decisions. The industry faces growing pressure to reduce carbon footprints, utilize recyclable materials, and align with circular economy principles. Innovations such as sleepers made from waste plastics, hybrid concrete composites, and recyclable designs are gaining traction. Regulatory frameworks in Europe and North America particularly favor sustainable infrastructure solutions. This evolving factor ensures that future growth will not just depend on volume but also on the ability of manufacturers to deliver eco-friendly and compliant sleeper technologies.

Railway Concrete Sleepers in India

Precast Concrete Industry in India: Industry scenario and key application areas

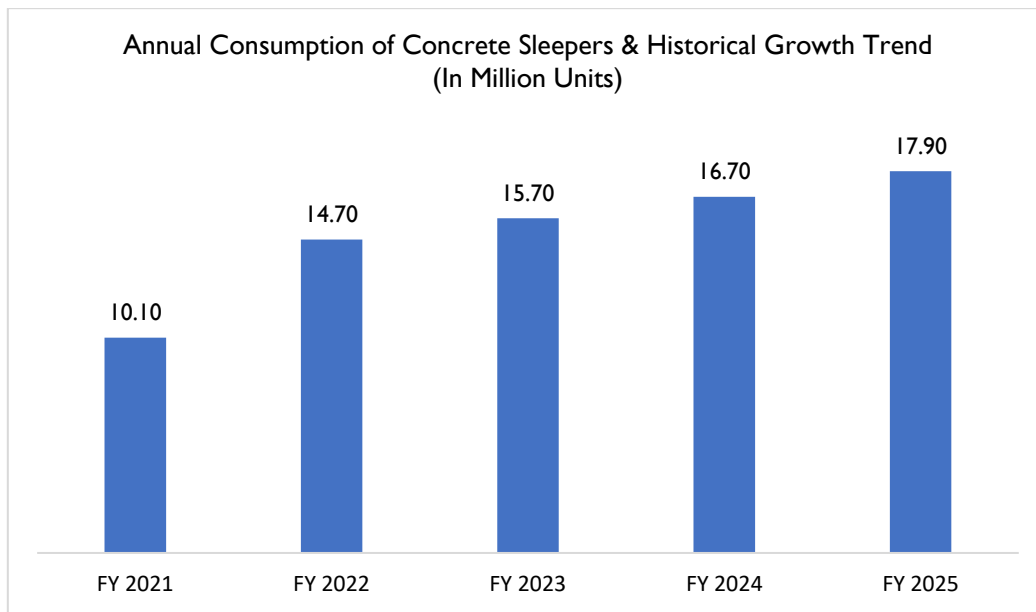
The Indian railway sector has become one of the world's largest consumers of precast concrete sleepers, driven by the government's consistent focus on modernization, electrification, and expansion of track networks. Indian Railways has almost completely transitioned from wooden to prestressed concrete (PSC) sleepers, with indigenous manufacturing capacity exceeding 15 million units annually. This massive demand has not only created a robust sleeper manufacturing ecosystem but also boosted the wider precast concrete industry, which benefits from cost efficiency, high durability, and the ability to standardize production across plants nationwide.

Beyond railways, the precast concrete industry in India is expanding rapidly due to urbanization, Smart City projects, and large-scale infrastructure programs such as metro networks, high speed railways, dedicated freight corridors, and industrial corridors. The sector benefits from reduced construction time, improved quality control, and suitability for mass infrastructure deployment. With sustainability considerations gaining importance, precast solutions are increasingly preferred for minimizing on-site waste and supporting circular economy practices in construction.

Key Applications:

- **Railway Sleepers (PSC Sleepers):** Precast sleepers are the backbone of Indian rail infrastructure, ensuring stability, uniform load distribution, and compatibility with modern high-speed and heavy-haul operations. Their long life and low maintenance needs make them ideal for India's massive track renewal programs.
- **Metro & Urban Rail Infrastructure:** Precast girders, segments, and station components are extensively used in metro projects across Delhi, Mumbai, Bangalore, and other cities. Precast ensures faster installation in congested urban environments while minimizing traffic disruption.
- **Bridges & Flyovers:** Precast elements such as girders, piers, and deck slabs are critical in bridge construction, offering durability and the ability to handle heavy traffic loads. Their standardized production also supports consistent quality across multiple large projects.
- **Commercial & Residential Buildings:** Precast wall panels, columns, beams, and flooring systems enable quicker construction cycles in housing and office projects. This application aligns with the growing demand for affordable housing and high-rise developments in urban India.
- **Industrial & Logistics Infrastructure:** Precast foundations, boundary walls, and flooring systems are widely used in warehouses, factories, and logistic parks. Their quick assembly and ability to handle heavy loads cater to the rapid expansion of e-commerce and manufacturing hubs.

Annual Consumption of Concrete Sleepers by Indian Railways & historical growth trends

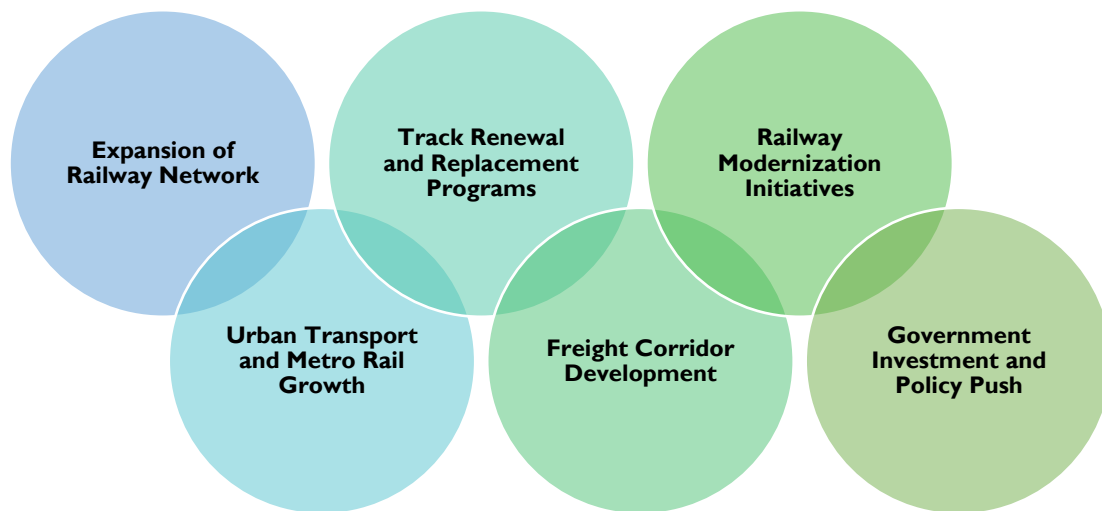


Source: D&B Insight Based on Primary Research

The annual consumption of concrete sleepers by Indian Railways has shown a consistent upward trend year on year between FY 2021 and FY 2025. In FY 2021, the demand was at 10.10 million units, marking the baseline for this period. By FY 2022, consumption had grown sharply to 14.70 million units, reflecting the first big jump driven by accelerated track renewal and expansion programs. This momentum continued in FY 2023, with demand reaching 15.70 million units, indicating sustained requirements despite the previous year's strong growth.

In FY 2024, the consumption further increased to 16.70 million units, highlighting the continuation of Indian Railways' modernization initiatives, including electrification projects and strengthening of freight corridors. By FY 2025, demand is estimated to rise to 17.90 million units, consolidating the steady upward path of sleeper consumption. Overall, between FY 2021 and FY 2024, the sector recorded a strong CAGR of 18.4%, showcasing rapid growth in this phase. This year-wise progression reflects both replacement demand for older infrastructure and new demand arising from India's expanding railway network, firmly establishing the foundation for the forecasted long-term growth.

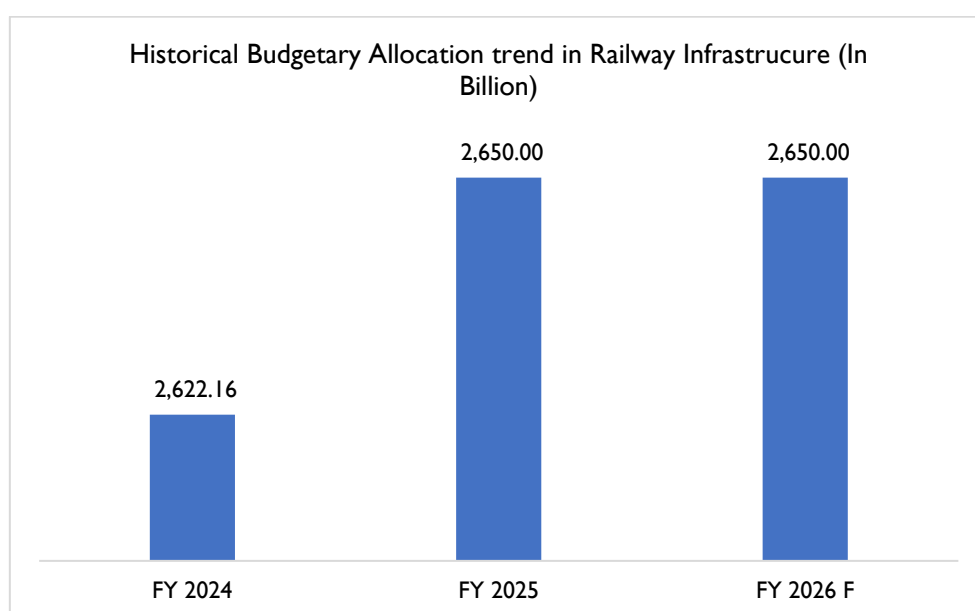
Analysis of key factors that are shaping the demand in the industry



- **Expansion of Railway Network:** India's ambitious rail expansion plans, including new freight corridors, high-speed rail projects, and connectivity to semi-urban and rural regions, are significantly driving sleeper demand. Every kilometre of new track requires thousands of sleepers, making network expansion the most direct growth driver. This not only sustains continuous procurement but also ensures long-term stability of demand for domestic sleeper manufacturers.
- **Track Renewal and Replacement Programs:** A major portion of India's railway budget is allocated toward maintenance and replacement of aging infrastructure. Wooden and steel sleepers are being phased out in favor of prestressed concrete sleepers that offer longer life and reduced maintenance. These large-scale track renewal programs create recurring demand, making the sleeper industry less dependent on new projects alone.
- **Railway Modernization Initiatives:** The Indian government's modernization agenda emphasizes high-speed rail, 100% electrification, and heavier axle-load operations. Concrete sleepers are essential to support higher speeds and loads, given their superior strength and stability. As modernization accelerates, demand for technologically advanced sleepers with better fatigue resistance and durability will continue to rise.
- **Urban Transport and Metro Rail Growth:** The rapid development of metro and suburban rail systems in major cities has created a new demand hub for concrete sleepers and other precast components. Metro rail corridors require high-quality sleepers designed for tight curves and high frequencies of operation. The growing number of metro projects under the Smart Cities Mission further reinforces steady demand.

- **Freight Corridor Development:** Dedicated Freight Corridors (DFC) are among the largest railway infrastructure projects in India. These corridors demand heavy-duty sleepers capable of handling high axle loads and continuous freight movement. The scale of sleeper requirement for DFCs alone runs into several million units, creating one of the most significant demand drivers in recent years.
- **Government Investment and Policy Push:** Consistent capital outlay in the Union Budget for railway infrastructure ensures reliable funding for sleeper procurement. Policies such as "Make in India" have encouraged indigenous manufacturing of precast concrete sleepers, reducing dependence on imports and ensuring faster supply. This policy-backed environment sustains growth while enabling long-term capacity planning for the industry.

Historical Government Allocation trend in Railway Infrastructure



Source: Ministry of Railways

The graph highlights the allocation trend in railway infrastructure over three financial years. In FY 2024, the allocation stood at INR 2,622.16 crore, which represents a slightly lower figure compared to the subsequent years. A significant increase is evident in FY 2025, when the allocation rose to INR 2,650.00 crore. This upward shift indicates a policy focus on boosting railway infrastructure investment, aimed at improving capacity, modernization, and network expansion.

Interestingly, the allocation remains steady at INR 2,650.00 crore in FY 2026 F, showing no incremental rise from the previous year. This stability suggests that the government intends to maintain consistent funding levels after the sharp increase from FY 2024, likely to ensure continuity in planned projects rather than introducing new major spending hikes. The trend reflects a strategy of consolidating the investment push made in FY 2025, allowing for execution and utilization of allocated resources effectively.

Roadmap for railway sector future growth and Major challenges in railway sector expansion

The Indian Railways has formulated the National Rail Plan (NRP) for India- 2030 with the goal of creating a “future-ready” rail system by 2030. Key strategic aims include raising the modal share of freight traffic to 45%, significantly reducing transit times for freight by targeting higher average speeds, and achieving 100% electrification of the broad-gauge network. To support growing demand beyond 2030, the plan also includes long-term capacity building measures through at least 2050.

Critical projects are being expedited as part of “Vision 2024”, which is incorporated in NRP, to accelerate implementation of projects such as multi-tracking of congested routes, elimination of level crossings on major Golden Quadrilateral / Golden Diagonal routes, and speed upgrades to 160 km/h on Delhi-Howrah and Delhi-Mumbai routes, and 130 km/h on other GQ/GD routes.

A major component of the roadmap is identifying and developing new infrastructure corridors: these include Dedicated Freight Corridors (DFCs), new High-Speed Rail Corridors, as well as assessing infrastructure needs in rolling stock (coaches, wagons), locomotives, terminals, and other key rail assets. The plan calls for periodic investment assessments and includes encouraging private sector participation in ownership/operation of rolling stock, development of passenger/freight terminals, and track infrastructure.

To ensure project implementation keeps pace, the government has also laid emphasis on using different financing models (including Public Private Partnerships), prioritizing safety and service quality, modernizing signalling and telecom systems, and upgrading stations under schemes like station redevelopment to improve passenger amenities and functional efficiency.

Major challenges in railway sector expansion:

- **High Capital Intensity and Long Gestation Period:** Railway infrastructure projects such as new lines, electrification, and modern station development require very high upfront investment and long construction timelines. The returns are spread over decades, which makes financing difficult. Despite significant government support, private participation often remains limited due to lower near-term profitability. This slows the pace of expansion and modernization.
- **Land Acquisition and Environmental Clearances:** Railway projects frequently face delays due to challenges in acquiring land, particularly in densely populated or agriculturally significant areas. Legal disputes and resistance from local communities extend timelines and escalate costs. Environmental clearances for tunnels, bridges, and forest land add another layer of complexity. These issues collectively cause major implementation bottlenecks.

- **Capacity Constraints and Operational Bottlenecks:** Even though India has one of the largest railway networks in the world, many routes operate beyond designed capacity. Congestion on high-density corridors delays both freight and passenger trains, reducing efficiency. Infrastructure expansion needs to keep pace with demand growth, but mismatches often cause logistical challenges. This gap in capacity vs demand remains a critical barrier.
- **Technological Modernization and Skill Gaps:** Upgrading signaling, safety systems, and adopting digital technologies requires not only investment but also skilled manpower. Introducing high-speed rail, smart ticketing, and automated systems demands expertise that is still developing within the sector. Bridging the technology gap while training the workforce poses a dual challenge for expansion. Without smooth adoption, productivity gains may remain limited.
- **Financial Sustainability and Fare Rationalization:** Railways struggle with balancing affordability for passengers and financial viability for the system. Passenger fares are often kept low for social reasons, while freight bears higher charges, impacting competitiveness with road transport. This imbalance restricts the capacity to reinvest earnings into infrastructure. Ensuring sustainable financial models remains a pressing challenge for long-term growth.

Raw material supply scenario in India, and major challenges for procuring the Raw material

The production of railway concrete sleepers in India depends heavily on the availability of key raw materials such as **cement, steel (reinforcement bars), coarse and fine aggregates, and admixtures**. India is the world's second-largest producer of cement and has a well-developed supply base, ensuring overall availability. Similarly, the steel sector, with integrated and secondary producers, provides reinforcement steel required in prestressed concrete sleepers. Aggregates are sourced locally from quarries and crushers, while admixtures are increasingly available from domestic and multinational chemical suppliers.

Despite overall sufficiency, supply chain imbalances arise due to demand surges, transportation bottlenecks, and regional disparities. Infrastructure projects such as housing, roads, and metro rail also compete for the same raw materials, creating pressure on availability and pricing. Thus, while India has a strong domestic base for raw materials, sustained procurement at stable costs remains a challenge for the sleeper manufacturing industry.

- **Cement:** India produces over 350 million tonnes of cement annually, with major clusters in states like Andhra Pradesh, Rajasthan, and Tamil Nadu. The availability of Ordinary Portland Cement (OPC) for sleepers is generally stable, but logistical costs due to regional supply imbalances can inflate procurement. During peak construction seasons, diversion of cement supply toward housing and urban infrastructure can cause periodic shortages for railway sleeper manufacturers.
- **Steel (Prestressing Wire / HTS Wires):** Steel is one of the costliest components in sleeper production, required in the form of high tensile strength (HTS) wires used for pre-stressing. India's steel industry, with giants like SAIL, Tata Steel, and JSW, provides a strong domestic base. However, fluctuating global iron ore and coking coal prices impact domestic steel pricing. Supply chain delays or export-driven shortages can hinder timely procurement for sleeper units, especially in high-volume railway expansion phases.
- **Aggregates (Coarse and Fine):** Aggregates are sourced from stone quarries and riverbeds and are crucial for concrete mix design in sleeper production. Supply is largely localized, mining plants depend on regional quarrying activities. Seasonal monsoon restrictions on mining and increasing environmental regulation on quarrying often disrupt supply. Additionally, transportation from distant quarries adds to costs and limits uniform quality.
- **Admixtures and Chemicals:** Modern concrete sleepers often use admixtures for workability, durability, and strength enhancement. These include plasticizers, retarders, and accelerators. The Indian chemical industry produces most of these domestically, supported by international suppliers.

Major challenges for procuring the Raw material:



Brief details about the use of that material

Railway concrete sleepers rely on a combination of cement, steel, aggregates, and admixtures to deliver the required strength, durability, and performance under heavy train loads. Each material has a specific function: cement as a binder, steel for tensile reinforcement, aggregates for bulk and compressive strength, and admixtures for enhancing workability and long-term durability. Together, these materials ensure that sleepers can withstand dynamic stresses, environmental exposure, and long service life requirements of modern rail networks.

• Cement

Cement is the binding material in concrete sleeper production and plays a critical role in providing strength and durability. Ordinary Portland Cement (OPC) of specified grade is generally used, as per RDSO and Indian Standards. In sleepers, cement ensures that aggregates and steel reinforcements are bonded firmly, creating a solid prestressed structure capable of withstanding heavy dynamic loads from trains. The quality of cement

affects compressive strength, permeability, and long-term durability of the sleepers. Variability in cement properties can compromise structural integrity, so procurement follows stringent specifications. Moreover, cement's availability and cost form a large part of production economics, making it a vital material in sleeper manufacturing.

- **Steel (Prestressing Wire / high-tensile steel wires)**

Steel is essential in sleeper production as it provides tensile strength through reinforcement. Prestressed concrete sleepers use high-tensile steel (HTS) wires or strands that are stretched before the concrete is poured, enabling the sleeper to withstand heavy axle loads and vibrations from rail traffic. This reinforcement prevents cracking and ensures durability under repeated stress cycles. HTS wires provide resilience against bending and dynamic forces, making sleepers robust and reliable. The use of steel ensures a long service life compared to traditional wooden sleepers, while strict adherence to mechanical properties, tensile strength, and corrosion resistance is mandatory as per Indian Railways' technical guidelines.

- **Aggregates (Coarse and Fine)**

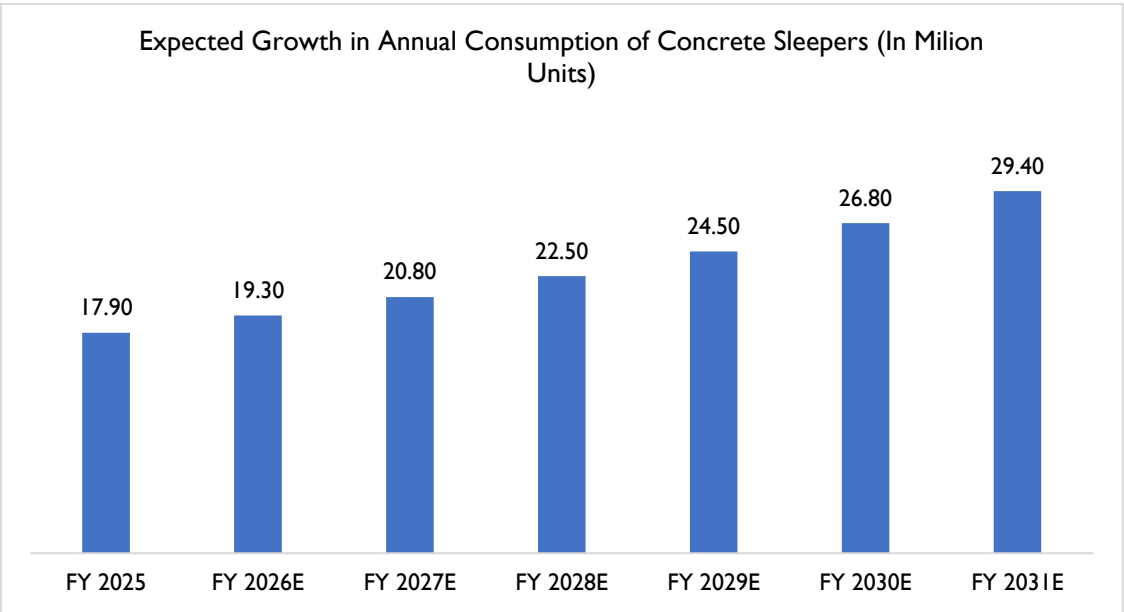
Aggregates form the bulk of the concrete mix in sleepers and contribute directly to volume, strength, and durability. Coarse aggregates (crushed stone) provide compressive strength and stiffness, while fine aggregates (sand) fill voids and ensure a dense, uniform structure. Proper grading and cleanliness of aggregates are critical, as impurities like clay or silt can weaken the bond with cement. In railway sleepers, aggregates must withstand freeze-thaw cycles, abrasion, and continuous load transfers. Their angular shape and rough texture ensure better interlocking, improving sleeper strength. Since aggregates make up more than 70% of the concrete mass, their quality and availability are crucial for consistent production.

- **Admixtures and Chemicals**

Admixtures are used in concrete sleepers to improve workability, strength, and durability. Plasticizers and superplasticizers enhance fluidity without increasing water content, which is vital in achieving dense, high-strength concrete. Retarders are sometimes added to delay setting during hot weather, ensuring uniform curing, while accelerators help achieve early strength in colder conditions. Special admixtures improve resistance to chloride penetration, sulphate attack, and other environmental factors. In railway sleepers, durability under varied climatic conditions is a priority, making chemical admixtures important for long service life. Their use also allows optimization of cement content, reducing costs and improving sustainability.

Growth forecast: Expected growth in Annual Consumption of Concrete Sleepers by Indian Railways

The annual consumption of concrete sleepers by Indian Railways is expected to grow steadily in the coming years. This growth is driven by ongoing infrastructure expansion, modernization of existing tracks, and a focus on durable and low-maintenance materials. Concrete sleepers are increasingly preferred over traditional options due to their strength and longer service life. Overall, the trend reflects India’s commitment to improving rail safety, efficiency, and capacity, supporting consistent demand in the sector.



Source: D&B Research, Insight Based on Primary Research

The graph illustrates a clear upward trend in the expected annual consumption of concrete sleepers by Indian Railways between FY 2025 and FY 2031. Starting from 17.9 million units in FY 2025, the demand is projected to rise steadily, reaching 29.4 million units by FY 2031. This consistent growth reflects the Indian Railways’ long-term infrastructure development plans, including network expansion, track renewal, and modernization initiatives. The growth trajectory shows a gradual but significant increase, with the annual demand expanding by nearly 11.5 million units over the forecast period.

This indicates not only the replacement demand for existing sleepers but also strong requirements for new railway projects, dedicated freight corridors, and high-speed rail initiatives. The compounded effect of these projects will sustain steady demand growth across the next decade. Another key driver behind this trend is the increasing shift towards concrete sleepers over traditional wooden or steel alternatives. Concrete offers superior durability, load-bearing capacity, and longer service life, making it the preferred choice for heavy-haul freight and high-speed passenger operations. As Indian Railways moves towards higher efficiency and safety standards, the adoption of concrete sleepers will continue to accelerate.

Overall, the forecast highlights a robust demand outlook, supported by both expansion and replacement needs. The rising consumption underscores the crucial role of sleepers in maintaining the structural reliability

of India's railway network. This trend also presents significant opportunities for domestic sleeper manufacturers, raw material suppliers, and associated industries catering to railway infrastructure growth.

Regulatory Landscape - Railway Concrete Sleepers

The regulatory landscape for railway concrete sleepers in India is defined by a combination of Indian Railways manuals, standards, and RDSO guidelines that ensure safe, durable, and standardized track infrastructure. These regulations cover all aspects of sleeper design, manufacturing, testing, installation, and maintenance, while also incorporating environmental and safety considerations.



Broader Impact on the Industry

The regulatory framework around railway concrete sleepers has a significant influence on how the industry functions, competes, and grows. By enforcing strict technical standards through the **Indian Railways Permanent Way Manual (IRPWM), IRS specifications, and RDSO drawings**, the government ensures uniformity, reliability, and interoperability across the vast railway network. This consistency fosters confidence among stakeholders but also raises the entry barriers for new or smaller players who may lack the technical and financial resources to meet stringent quality norms.

For established manufacturers, these regulations create a stable and predictable demand environment. Since only certified products can be procured, suppliers with proven compliance capabilities benefit from long-term contracts and recurring business opportunities, particularly as Indian Railways continues its modernization and capacity expansion programs. However, the need for advanced testing, pre-stressing techniques, and quality control infrastructure also increases capital intensity, pushing the industry toward consolidation and favouring larger, well-resourced players.

On the operational side, **environmental and safety considerations** embedded in the regulatory framework are shaping production methods and supply chains. The industry is moving toward greener cement, recycled aggregates, and energy-efficient curing processes, aligning itself with national sustainability goals. While this transition entails higher upfront costs, it positions manufacturers competitively in the long run, especially for export markets where ESG compliance is increasingly a prerequisite.

Overall, the regulatory landscape acts as both a safeguard and a growth enabler: it protects the railway system through strict compliance, encourages modernization and sustainability, and ensures reliable demand for sleeper manufacturers. At the same time, it challenges the industry to continuously invest in technology, process efficiency, and compliance mechanisms, thereby raising the competitive threshold and driving sectoral consolidation.

Analysis of key regulatory policies / programs that has an impact on the industry



- **Mandate for Concrete Sleepers in Track Construction:** The adoption of pre-stressed concrete (PSC) sleepers is a cornerstone of Indian Railways' Track Modernization Program, which aims to enhance safety, reliability, and operational efficiency. This initiative includes the implementation of 60 kg high-strength rails with a 90 N/mm² Ultimate Tensile Strength (UTS) on concrete bases, as well as the introduction of fan-shaped turnouts. These measures are being adopted across various zones, including East Central Railway, Western Railway, and Metro Railway Kolkata, to standardize track structures and improve performance on high-density routes. The use of PSC sleepers is particularly beneficial for high-speed and heavy-density traffic, offering advantages such as higher frame resistance, reduced stress on ballast and rail pads, and improved track reliability and maintainability.

Impact: This mandate guarantees consistent demand for PSC sleepers, creating a stable market for manufacturers while phasing out older alternatives. It raises quality benchmarks and favors larger players with modern production capacities.

- **Increased Capital Expenditure for Railways:** In the Union Budget 2024, the Government of India allocated a record capital expenditure of ₹2,622 billion for Indian Railways, with a Gross Budgetary Support of ₹2,522 billion, highlighting a strong commitment to modernizing the rail network. A significant portion of this investment is directed towards modernizing track infrastructure, including the replacement of wooden sleepers with prestressed concrete (PSC) sleepers, adoption of long-welded rails, electrification, and advanced signalling systems. The budget also emphasizes private sector participation through Public-Private Partnerships (PPP) for infrastructure projects, fostering efficiency and

innovation. Overall, this capital outlay aims to enhance safety, operational efficiency, and capacity, transforming Indian Railways into a world-class, technologically advanced network.

Impact: The record investment directly boosts large-scale procurement of sleepers, ensuring a multi-year demand pipeline. It also opens opportunities for PPPs, pushing manufacturers to scale capacity and strengthen compliance.

- **Promotion of Sustainable Practices:** The Government of India is promoting sustainability in the railway sector as part of its broader commitment to achieving net-zero carbon emissions by 2030. A notable initiative is the installation of removable solar panel systems between railway tracks at Banaras Locomotive Works (BLW). This approach efficiently utilizes existing track space without requiring additional land acquisition, thereby minimizing environmental impact. The solar panels supply clean energy for railway operations, reducing dependence on conventional energy sources and contributing to lower carbon emissions. This initiative is part of Indian Railways' larger focus on renewable energy adoption, including solar rooftops at stations and electrification projects aimed at improving energy efficiency. These efforts are in line with the Ministry of Railways' sustainability goals and are supported by national initiatives such as the National Electric Mobility Mission Plan.

Impact: Sustainability requirements are driving the adoption of green production methods, raising short-term costs but improving long-term competitiveness. Manufacturers aligning with ESG goals gain an edge in government contracts.

- **Development of Economic Railway Corridors:** Under the PM Gati Shakti Mission, the government has identified and is developing three major economic railway corridors Energy, Mineral, and Cement Corridors to strengthen the logistics network and support industrial growth. These corridors, covering 40,900 km across 192 projects with an estimated investment of ₹11.16 trillion, are designed to enhance connectivity between mining regions, power plants, and industrial hubs. As of December 2024, 55 projects spanning 5,723 km with a cost of around ₹1.03 lakh crore have been sanctioned, focusing on track doubling, capacity expansion, and alternative routes to decongest existing lines. By improving the efficient movement of bulk commodities like coal, iron ore, and cement, these corridors are expected to lower logistics costs, boost supply chain reliability, and facilitate infrastructure development benefiting sectors such as concrete sleeper manufacturing that rely on consistent access to raw materials and transport networks.

Impact: Corridor projects create sustained demand for PSC sleepers through track doubling and new routes. They also improve raw material logistics, reducing input costs and enhancing supply chain efficiency for producers.

- **Focus on Indigenous Manufacturing:** The Government of India emphasizes the use of indigenously available raw materials such as cement, steel, and aggregates in the manufacturing of prestressed concrete (PSC) sleepers. This aligns with the Atmanirbhar Bharat initiative, which aims to boost domestic industries and reduce dependence on imports. By encouraging local sourcing, the policy ensures the steady availability of materials while maintaining quality standards as per IRS T-39 and Indian Railways Construction Manual guidelines. It also supports regional employment and strengthens supply chains critical to railway infrastructure projects. Government schemes like the Production-Linked Incentive (PLI) program further facilitate investments in local manufacturing capacities.

Impact: Local sourcing policies stabilize material availability and reduce reliance on imports. This strengthens domestic supply chains while raising quality expectations, supporting self-reliance under Atmanirbhar Bharat.

Dependence on DFCCIL Procurement Pipeline and Project Execution Timelines ¹⁴

The Dedicated Freight Corridor Corporation of India Limited ("DFCCIL"), a Government of India enterprise under the Ministry of Railways, is responsible for the planning, construction, operation and maintenance of the Dedicated Freight Corridors ("DFCs") in India. As part of the development of these corridors, DFCCIL procures railway infrastructure components, including pre-stressed concrete (PSC) sleepers, rails, turnouts, ballast, signalling and telecommunication systems, overhead electrification equipment and other civil and track-related infrastructure through competitive bidding processes conducted primarily on the Indian Railways E-Procurement System (IREPS). Unlike procurement undertaken by Indian Railways for routine maintenance, replacement and network augmentation, procurement under the Dedicated Freight Corridor programme is primarily linked to the execution of specific corridor packages and project implementation milestones.

Accordingly, the timing of tender issuance, bid evaluation and contract awards under the DFC programme is dependent upon the progress of individual projects and may vary based on factors such as engineering readiness, land acquisition, statutory approvals, contractor mobilisation, construction progress, funding availability and overall implementation schedules. Although DFCCIL continues to maintain an active tendering

¹⁴ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2209199&lang=2®=48>
<https://dfccil.com/>
<https://www.ireps.gov.in/>
<https://indianrailways.gov.in/railwayboard/>

environment, procurement opportunities are generally released in phases corresponding to project implementation milestones. Consequently, procurement visibility may vary across different stages of corridor development, and the timing of procurement may be influenced by project re-phasing, deferment of construction activities, modifications in technical specifications, re-tendering of contracts or delays in project execution.

As per the Economic Survey 2025–26, approximately 2,741 km (96.4%) of the planned 2,843 km Dedicated Freight Corridor network had been commissioned as of October 2025, comprising the fully commissioned Eastern Dedicated Freight Corridor (1,337 km) and 1,404 km of the Western Dedicated Freight Corridor (1,506 km). The Survey notes that the DFC network has enhanced freight transportation efficiency by reducing transit time, increasing line capacity and decongesting the conventional railway network. Further, the DFCCIL Annual Report 2024–25 states that 1,30,116 freight trains operated on the DFC network during FY2025, representing a 48% year-on-year increase, while the average daily train operations reached 403 trains in March 2025. During the same period, Net Tonne Kilometres (NTKM) increased by 68% to 1,11,898 million, and Gross Tonne Kilometres (GTKM) increased by 61% to 1,92,146 million, reflecting the increasing utilisation and freight carrying capacity of the network.

The Government of India has also announced the development of additional Dedicated Freight Corridor projects and associated rail connectivity initiatives to strengthen the country's multimodal logistics infrastructure. While these initiatives indicate continued long-term investment in freight rail infrastructure, procurement under the Dedicated Freight Corridor programme is expected to continue to follow a phased, project-driven approach aligned with the planning, construction and commissioning schedules of individual corridor packages. Accordingly, procurement activity within the sector is expected to remain closely linked to project implementation timelines and milestone-based execution throughout the development of the Dedicated Freight Corridor network.

Threats & Challenges - Railway Concrete Sleepers

Key Threats:



- **Competition from Alternative Materials:** While concrete sleepers remain the standard for track stability and durability, newer materials such as composite, polymer, or fiber-reinforced sleepers are gaining market share. These alternatives offer advantages like corrosion resistance, lighter weight, and lower maintenance requirements. Railway operators exploring long-term cost efficiency and sustainability may prefer these options, leading to reduced demand for traditional concrete sleepers. The industry, therefore, faces competitive pressure to innovate and justify its value proposition.
- **Environmental Regulations and Sustainability Pressures:** Cement, a primary component in concrete sleepers, is associated with high carbon emissions during production. With global and domestic commitments toward reducing greenhouse gases, stricter environmental regulations and sustainability guidelines are being enforced. Companies may need to invest in cleaner technologies, alternative materials, or carbon offset mechanisms to remain compliant. These investments can be capital-intensive and may increase operational costs, especially for smaller or mid-sized manufacturers.
- **Quality Compliance and Certification Risks:** Concrete sleepers must conform to rigorous safety and performance standards defined by regulatory bodies such as the Research Designs and Standards Organisation (RDSO). These standards cover load-bearing capacity, durability, resistance to environmental factors, and safety during installation. Failure to meet these guidelines can result in project rejections, financial penalties, or contractual disputes. Moreover, reputational damage arising from non-compliance can affect a company's ability to win new contracts or secure financing for expansion.

Key Challenges:



- **High Capital Investment Requirements:** The manufacturing process for concrete sleepers is capital intensive. It requires significant investments in batching plants, molds, curing chambers, cranes, and testing

equipment to ensure that sleepers meet the required strength and durability standards. For new entrants or smaller manufacturers, securing funding for such infrastructure is a major challenge. Additionally, establishing facilities near project sites often demands land acquisition, utilities setup, and logistical arrangements, all of which add to the upfront cost. Without adequate financing or government support, companies may struggle to scale operations or modernize production methods.

- **Skilled Workforce Availability:** The production and installation of concrete sleepers demand skilled labour at every stage from mixing and casting to curing and quality testing. Handling heavy materials and machinery requires trained operators, while curing procedures demand strict adherence to timelines and temperature controls. In regions where there is a shortage of technically qualified manpower or where training infrastructure is limited, companies face disruptions in production schedules, increased error rates, and heightened safety risks. Recruiting and retaining qualified staff, therefore, remains a persistent challenge for manufacturers.
- **Technological Upgradation and Process Optimization:** As global and domestic railway networks adopt advanced technologies, concrete sleepers must evolve to meet newer requirements such as higher load-bearing capacity, resistance to weather conditions, and longer life cycles. Incorporating automation, robotics, and improved curing techniques can enhance efficiency and product quality but requires considerable investment in research and development. Many companies face difficulties in balancing the cost of upgrading processes with the market's ability to absorb higher prices. Furthermore, staying abreast of technological trends demands continuous innovation and partnerships with research bodies, which may not be feasible for smaller players.
- **Logistical and Distribution Challenges:** Concrete sleepers are large, heavy, and cumbersome to transport. Moving them from manufacturing facilities to railway sites often located in rural or remote regions requires specialized equipment, careful planning, and adequate infrastructure. Poor road connectivity, lack of storage facilities, or delays in transportation can lead to increased costs and potential wastage. Improper handling during transit can cause cracking or structural damage, affecting the sleeper's performance and lifespan. These logistical challenges not only inflate project costs but also slow down delivery timelines, impacting the overall efficiency of railway construction or maintenance projects.
- **Maintenance of Quality Standards Across Multiple Projects:** With railway projects spread across diverse geographical regions, maintaining uniform product quality is a significant challenge. Variations in raw material sources, local climate conditions, or manpower expertise can lead to inconsistencies in manufacturing outcomes. Adhering to the standards set by regulatory bodies like the Research Designs and Standards Organisation (RDSO) requires strict monitoring systems, frequent inspections, and robust

documentation practices. In large projects involving multiple suppliers and subcontractors, ensuring that every sleeper meets design specifications becomes complex. Any deviation from prescribed standards can lead to project delays, increased maintenance costs, or safety concerns, thus posing operational and reputational risks.

RDSO Vendor Approval Framework for Vendor Screening & Selection in Indian Railways¹⁵

Procurement Framework of Indian Railways

Indian Railways is one of the world's largest railway networks, operating an extensive network of passenger and freight services across the country. To support the construction, maintenance and expansion of this network, Indian Railways procures a wide range of products including track components, bridges, signalling equipment, electrification systems, rolling stock, safety equipment and other railway infrastructure materials. Considering that many of these products are deployed in safety-critical applications, procurement is governed by a structured technical and quality assurance framework established by the Ministry of Railways.

Within this framework, the **Railway Board** is responsible for formulating policies relating to procurement, technical governance and quality assurance across Indian Railways. The **Research Designs and Standards Organisation ("RDSO")**, functioning under the Ministry of Railways, serves as the principal technical organisation responsible for developing specifications, standards, inspection requirements and vendor approval procedures for designated railway products. Together, these institutions seek to ensure that products supplied to Indian Railways meet prescribed technical specifications and quality requirements before being deployed across the railway network. Unlike conventional industrial procurement, where supplier selection may primarily depend on commercial and technical evaluation during the tendering process, procurement of several railway products requires manufacturers to undergo a technical qualification process before they become eligible to participate in procurement. This approach enables Indian Railways to evaluate the manufacturing capability and quality management systems of prospective suppliers before products are introduced into railway operations.

Role of RDSO in Vendor Screening and Selection

The Research Designs and Standards Organisation performs a central role in the technical evaluation of vendors supplying designated products to Indian Railways. In addition to formulating technical specifications and product standards, RDSO is responsible for establishing vendor approval procedures, assessing

¹⁵ https://rdsso.indianrailways.gov.in/works/uploads/File/QC-G-7.1-1%20ver%207.0_11.08.2017.pdf

manufacturing capability, evaluating prototype products (where applicable), conducting inspections and monitoring the continued performance of approved vendors. The vendor approval framework developed by RDSO is intended to ensure that manufacturers possess the necessary production capability, testing infrastructure, inspection facilities and quality assurance systems required to consistently manufacture products conforming to the applicable specifications. Accordingly, vendor approval extends beyond evaluating the quality of an individual product and focuses on assessing whether the manufacturer's overall production system is capable of consistently delivering products meeting the prescribed standards.

For product categories where RDSO approval has been prescribed, manufacturers are generally required to obtain approval before becoming eligible to participate in procurement by Indian Railways. Once approval is granted, the manufacturer is included in the applicable list of approved vendors maintained by RDSO. Approved vendors continue to remain subject to surveillance, quality audits and performance monitoring in accordance with the applicable procedures, thereby making vendor approval an ongoing quality assurance mechanism rather than a one-time approval exercise.

Objectives of the RDSO Vendor Approval Framework

The RDSO vendor approval framework has been developed to establish a uniform technical qualification process for manufacturers supplying designated railway products. The framework seeks to ensure that products deployed within the railway system are manufactured by vendors possessing adequate production capability, technical competence and quality management systems.

Broadly, the framework seeks to:

- establish a uniform process for technical evaluation of manufacturers;
- assess manufacturing capability before commercial supply;
- verify the adequacy of production infrastructure, inspection arrangements and testing facilities;
- evaluate quality assurance systems adopted by manufacturers;
- ensure consistent compliance with applicable RDSO specifications; and
- support quality, reliability and operational safety across the railway network through continued surveillance of approved vendors.

By evaluating both the manufacturing process and the organisational capability of the supplier, the approval framework seeks to minimise the risk of quality variations and ensure consistency in the supply of designated railway products.

Key Elements of the Vendor Approval Framework:

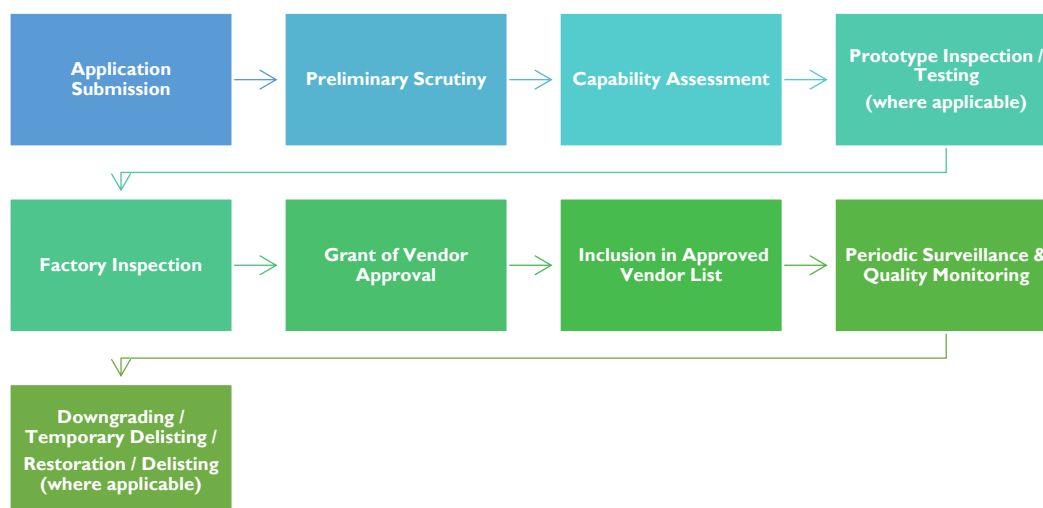
- **The RDSO vendor approval framework comprises multiple stages of technical evaluation**, each designed to assess different aspects of a manufacturer's capability before approval is granted.
- **The evaluation process may include** scrutiny of technical documentation, capability assessment, prototype inspection/testing, factory inspection and verification of quality assurance systems, depending on the applicable product category.
- **The framework evaluates the manufacturer's overall capability**, including manufacturing facilities, production processes, inspection arrangements, testing infrastructure and quality management systems, rather than relying solely on product testing.
- **Successful completion of the prescribed evaluation stages** enables the manufacturer to be included in the relevant RDSO approved vendor list for designated product categories.
- **Vendor approval is an ongoing quality assurance mechanism**, with approved manufacturers remaining subject to periodic surveillance, quality audits and performance monitoring to ensure continued compliance with applicable technical requirements.
- **Where quality deficiencies or non-conformities are identified**, RDSO may require corrective actions and, where necessary, revise the vendor's approval status in accordance with the prescribed guidelines, including downgrading, suspension or delisting where applicable.

Significance of the RDSO Approval Framework:

- **The RDSO vendor approval framework serves as a key technical qualification mechanism** within the Indian Railways procurement ecosystem, ensuring that designated railway products meet prescribed technical specifications and quality requirements.
- **The framework evaluates manufacturing capability, technical competence and quality assurance systems** before procurement to ensure consistent product quality throughout the manufacturing lifecycle.
- **RDSO approval is generally a prerequisite for participation in procurement opportunities** for designated product categories where such approval has been prescribed by Indian Railways.
- **Manufacturers are required to successfully complete the prescribed approval process** before becoming eligible to participate in procurement requiring RDSO-approved vendors.
- **The framework promotes continued compliance through periodic surveillance, inspections and quality monitoring**, ensuring that approved vendors consistently meet the prescribed technical and quality standards.
- **Ongoing monitoring supports product quality, operational reliability and continued eligibility** of approved vendors within the Indian Railways supply chain.

RDSO Vendor Approval Process – From Application to Final Approval ¹⁶

For product categories where vendor approval has been prescribed, manufacturers are generally required to complete the applicable RDSO approval process before becoming eligible to participate in procurement by Indian Railways. The approval framework follows a structured sequence of technical evaluations designed to assess not only whether the product complies with the applicable specifications, but also whether the manufacturer possesses the capability to consistently produce products meeting the prescribed quality and performance requirements. The approval process typically progresses through multiple stages, beginning with the submission of an application and concluding with inclusion of the manufacturer in the applicable RDSO approved vendor list. Since each stage serves a distinct technical objective, progression to the subsequent stage generally depends upon satisfactory completion of the preceding evaluation. Consequently, observations raised during any stage of the approval process may require additional clarification, corrective action or re-evaluation before approval can be granted.



- ❖ **Application Submission:** The approval process commences with the submission of an application by the manufacturer through the RDSO Vendor Approval System, together with the prescribed technical documentation and supporting information applicable to the relevant product category. Depending on the applicable approval guidelines, the submission may include details relating to the manufacturing facility, production processes, quality assurance systems, inspection arrangements, testing infrastructure, technical personnel and previous manufacturing experience, wherever prescribed. At this stage, the objective is to provide RDSO with sufficient information to establish the applicant's eligibility for evaluation and facilitate the subsequent stages of technical assessment. Since the approval framework is document-driven, completeness and accuracy of the submitted information play an important role in enabling timely processing of the application.

¹⁶ <https://rdso.indianrailways.gov.in/index.jsp>

- ❖ **Preliminary Scrutiny of Application:** Following receipt of the application, RDSO undertakes a preliminary scrutiny of the submitted documents to verify compliance with the prescribed eligibility requirements and ensure that the necessary technical information has been furnished. During this stage, RDSO may seek additional information or clarifications where documentation is incomplete or requires further explanation. The preliminary scrutiny therefore acts as an initial verification stage before the application progresses to technical evaluation. Where the prescribed information is not available or additional clarification is required, the overall approval timeline may be influenced by the time taken to address such observations.
- ❖ **Capability Assessment:** Capability assessment represents one of the most significant stages of the RDSO vendor approval framework. Unlike product-based evaluation alone, this stage seeks to determine whether the manufacturer possesses the infrastructure and organisational capability necessary to consistently manufacture products conforming to the applicable RDSO specifications. As part of the assessment, RDSO evaluates several aspects of the manufacturing organisation, including the adequacy of production facilities, manufacturing equipment, inspection arrangements, testing capability, quality assurance systems and process controls. Depending on the applicable approval procedure, the assessment may also consider calibration systems, quality documentation, manufacturing practices and the availability of technically qualified personnel responsible for production and quality assurance. The emphasis on manufacturing capability reflects the objective of ensuring that product quality can be consistently maintained across commercial production rather than being demonstrated only through a single sample or prototype. Where observations are identified during capability assessment, manufacturers may be required to implement corrective measures before the approval process progresses further. Consequently, this stage plays a significant role in determining the overall timeline for vendor approval.
- ❖ **Prototype Inspection and Testing (Where Applicable):** For product categories requiring prototype approval, manufacturers are generally required to demonstrate conformity of prototype products with the applicable RDSO specifications before commercial approval is considered. Depending on the nature of the product, prototype evaluation may involve inspection, laboratory testing, dimensional verification, functional assessment or other technical evaluations prescribed under the applicable RDSO specifications. The purpose of prototype evaluation is to verify that the proposed product satisfies the prescribed performance and technical requirements before it enters commercial production for Indian Railways. Where the prototype does not fully satisfy the applicable specifications or observations are identified during testing, manufacturers may be required to undertake design modifications, process improvements or repeat testing before the approval process proceeds further.

Accordingly, prototype evaluation represents an important quality assurance measure within the overall approval framework.

- ❖ **Factory Inspection:** Following satisfactory completion of the applicable technical evaluations, RDSO may undertake inspection of the applicant's manufacturing facility in accordance with the applicable approval procedure. The inspection is intended to verify whether the manufacturing infrastructure, production processes, inspection systems and quality assurance arrangements described during the application and capability assessment stages are effectively implemented within the manufacturing facility. Factory inspection also provides an opportunity to assess production controls, testing arrangements, inspection practices and the overall manufacturing environment supporting commercial production. Where inspection observations require corrective action, manufacturers may be required to address such observations before approval is granted.
- ❖ **Grant of Vendor Approval:** Upon satisfactory completion of the applicable stages of technical evaluation, RDSO may grant vendor approval in accordance with the prescribed procedures for the relevant product category. Approved manufacturers are generally included in the applicable RDSO approved vendor list, which is maintained for designated product categories. Inclusion in the approved vendor list enables manufacturers to participate in procurement opportunities where RDSO approval has been prescribed as an eligibility requirement, subject to compliance with the applicable tender conditions. Grant of approval therefore represents the completion of the initial technical qualification process rather than the conclusion of the manufacturer's compliance obligations.
- ❖ **Post-Approval Surveillance:** The RDSO vendor approval framework extends beyond the grant of approval through a structured surveillance mechanism intended to monitor continued compliance with the prescribed technical and quality requirements. Approved vendors remain subject to periodic surveillance, inspections, quality audits and performance monitoring in accordance with the applicable RDSO procedures. The objective of surveillance is to verify that the manufacturing processes, quality assurance systems and product quality continue to satisfy the prescribed standards after commercial production has commenced. This ongoing oversight distinguishes the RDSO approval framework from a one-time certification process and reinforces continued quality assurance throughout the vendor's approval period.
- ❖ **Downgrading, Temporary Delisting, Restoration and Delisting:** Where quality deficiencies, non-conformities or other observations are identified during surveillance or quality monitoring, the applicable RDSO procedures provide for various actions depending on the nature and severity of the observations. These actions may include downgrading of vendor status, temporary delisting, restoration following

satisfactory corrective action or outright delisting, as provided under the applicable RDSO guidelines. The availability of these measures enables RDSO to maintain oversight over approved vendors while encouraging continued compliance with the prescribed technical specifications and quality requirements throughout the approval lifecycle.

Key Challenges and Business Implications of the RDSO Vendor Approval Framework

While the RDSO vendor approval framework is intended to ensure uniform technical standards, product quality and operational safety across Indian Railways, it also establishes a structured technical qualification process for manufacturers seeking to supply designated railway products. Since the approval framework evaluates not only the product but also the manufacturer's overall production capability, quality management systems and technical competence, new vendors are generally required to demonstrate compliance across multiple operational and technical parameters before becoming eligible to participate in procurement opportunities where RDSO approval is prescribed. Consequently, manufacturers entering product categories covered under the RDSO approval framework may encounter a series of technical, operational and commercial considerations throughout the approval lifecycle, from initial application through post-approval surveillance.

RDSO Approval Stage / Key Challenge	Description	Potential Business Implication
Demonstrating Manufacturing Capability (Capability Assessment)	RDSO evaluates manufacturing facilities, production equipment, inspection arrangements, testing capability and quality assurance systems to assess whether the manufacturer can consistently produce products conforming to prescribed specifications. New entrants may need to establish or upgrade manufacturing infrastructure to meet approval requirements.	Manufacturers may need to invest in manufacturing capability and operational readiness before progressing through the approval process, potentially increasing the time required to achieve commercial qualification.
Investment in Testing Infrastructure and Quality Systems	Manufacturers are expected to demonstrate adequate inspection facilities, testing infrastructure, calibration practices and documented quality assurance systems throughout the manufacturing process.	Establishment or enhancement of testing facilities and quality management systems may require additional operational investment and preparation before approval can be obtained.
Requirement for Technical Expertise and Skilled Manpower	Compliance with RDSO specifications requires qualified personnel capable of interpreting technical standards, managing controlled manufacturing processes, maintaining quality documentation and conducting inspection and testing activities.	Availability of experienced technical and quality personnel may influence the manufacturer's ability to successfully complete technical evaluation and maintain continued compliance after approval.

Prototype Development and Product Validation	For products requiring prototype approval, manufacturers must demonstrate conformity of prototype products with prescribed technical specifications through inspection and testing. Observations may require design modifications, process improvements or repeat testing.	Prototype development and validation may involve multiple evaluation cycles, potentially affecting product development timelines and delaying market entry.
Sequential Nature of the Approval Process	The approval process consists of multiple interdependent stages, including document scrutiny, capability assessment, prototype inspection and factory inspection. Progression depends on satisfactory completion of preceding stages.	Delays, observations or corrective actions at any stage may extend the overall approval timeline and postpone commercial qualification.
Eligibility to Participate in Procurement	RDSO approval is generally a prerequisite for participation in procurement opportunities for designated railway products. Manufacturers without approval may not be eligible to participate in relevant tenders.	The time required to obtain approval may influence when a manufacturer can access procurement opportunities and commence business with Indian Railways.
Continued Compliance After Approval	Approved vendors remain subject to periodic surveillance, inspections, quality audits and performance monitoring to ensure continued compliance with prescribed standards.	Ongoing operational discipline, quality management and adherence to technical requirements are necessary to maintain approved vendor status throughout the vendor lifecycle.
Risk of Downgrading, Temporary Delisting and Delisting	Quality deficiencies, adverse audit observations or continued non-conformities identified during surveillance may result in downgrading, temporary delisting, restoration after corrective action or outright delisting.	Changes in vendor approval status may impact eligibility to participate in procurement opportunities requiring RDSO approval until approval status is restored, potentially affecting business continuity and access to railway orders.
Application & Documentation Requirements	Manufacturers are required to submit complete technical documentation, compliance records and supporting information as part of the approval process. Incomplete submissions may lead to queries or requests for clarification.	Additional time may be required before technical evaluation can commence, potentially extending the approval timeline.
Factory Inspection	RDSO verifies implementation of manufacturing processes, quality controls, testing arrangements and production systems through on-site inspection of manufacturing facilities.	Inspection observations may necessitate corrective actions or re-inspection, which may influence approval timelines and readiness for commercial participation.

Strategic Importance of the RDSO Vendor Approval Framework and Overall Business Implications

The RDSO vendor approval framework forms an integral component of the procurement and quality assurance ecosystem of Indian Railways. As Indian Railways operates one of the world's largest rail networks, supplying products that are deployed in safety-critical applications requires adherence to uniform technical specifications and quality standards. Accordingly, the vendor approval framework seeks to establish a structured mechanism for evaluating whether manufacturers possess the capability to consistently produce products that conform to the prescribed technical requirements before they are introduced into railway operations. Unlike procurement systems that primarily evaluate suppliers during the commercial tendering stage, the RDSO framework incorporates a pre-qualification mechanism for designated product categories. This approach enables technical capability and manufacturing readiness to be assessed independently of commercial evaluation, thereby supporting consistency in product quality and operational reliability across the railway network.

Importance of RDSO Approval in the Indian Railways Procurement Ecosystem

- **RDSO approval serves as a prerequisite** for manufacturers to participate in procurement for designated product categories where such approval is mandated by Indian Railways.
- **Obtaining RDSO approval is a key milestone** for manufacturers seeking to supply railway products, as it establishes technical eligibility before participation in procurement.
- **The approval framework evaluates manufacturing capability**, including production infrastructure, inspection arrangements, testing facilities and quality assurance systems, before commercial supplies commence.
- **The framework helps minimise quality risks** by ensuring that only technically qualified manufacturers meeting prescribed standards are approved for designated railway products.
- **RDSO approval establishes a standardised technical screening mechanism**, enabling uniform vendor evaluation across different railway zones and production units.
- **Continued compliance with RDSO specifications** supports consistency, reliability and operational safety of products supplied to the Indian Railways network.

RDSO Approval Extends Beyond Product Certification:

An important characteristic of the RDSO approval framework is that it evaluates the manufacturer's overall capability rather than focusing solely on the technical performance of an individual product. The assessment extends to manufacturing infrastructure, production processes, testing capability, inspection arrangements, quality management systems and organisational controls that support consistent manufacturing. This broader

evaluation reflects the objective of ensuring that product quality can be maintained throughout commercial production and not merely demonstrated during a single inspection or test. Similarly, continued surveillance after approval reinforces the principle that vendor qualification is an ongoing process. Periodic quality monitoring enables RDSO to assess whether approved manufacturers continue to satisfy the prescribed technical and quality requirements during the course of commercial production.

Implications for New Vendors Entering the Railway Supply Chain:

For manufacturers entering railway product categories for the first time, the approval framework may require significant organisational preparedness before commercial participation becomes possible. In addition to establishing manufacturing capability, new applicants may need to demonstrate the adequacy of production facilities, inspection systems, testing capability, documented quality assurance procedures and technical competence in accordance with the applicable approval requirements. Depending upon the applicable product category, prototype development, product validation and factory inspection may also form part of the approval process. Accordingly, obtaining RDSO approval may involve both operational preparation and technical qualification before manufacturers become eligible to participate in procurement opportunities where such approval is prescribed.

Importance of Continued Compliance:

The significance of RDSO approval extends beyond obtaining initial approval. Approved manufacturers remain subject to surveillance, inspections and quality monitoring throughout the approval period in accordance with the applicable RDSO procedures. This continued oversight places emphasis on maintaining consistent manufacturing practices, effective quality assurance systems and compliance with the prescribed technical requirements during commercial production. Where quality deficiencies or non-conformities are identified, the applicable procedures provide for corrective measures and revision of vendor approval status, including downgrading, temporary delisting, restoration or outright delisting, depending upon the circumstances. Accordingly, continued compliance represents an integral aspect of participation within the railway supply chain for designated product categories.

Overall Business Implications

The RDSO vendor approval framework has implications across multiple stages of a manufacturer's participation in the railway sector, beginning with initial technical qualification and continuing throughout the period during which the manufacturer remains an approved vendor. From the perspective of a new manufacturer, obtaining approval may require investments in manufacturing capability, testing infrastructure, inspection systems, quality assurance processes and technical expertise necessary to satisfy the prescribed approval requirements. Since the approval process progresses through multiple technical evaluations, the

overall timeline for obtaining approval may be influenced by the observations arising during capability assessment, prototype inspection, document verification or factory inspection. For product categories where RDSO approval is prescribed as an eligibility requirement, manufacturers generally become eligible to participate in procurement opportunities only after successfully completing the applicable approval process. Consequently, delays in obtaining approval may influence the timing at which a manufacturer can access procurement opportunities within the Indian Railways ecosystem. Following approval, vendors are expected to maintain continued compliance with the applicable technical and quality requirements. Continued surveillance and quality monitoring therefore remain important aspects of vendor participation throughout the approval lifecycle.

Regulatory Framework Governing Vendor Approval by Research Designs and Standards Organisation (RDSO)¹⁷

The Research Designs and Standards Organisation ("RDSO"), under the Ministry of Railways, is the principal technical authority responsible for prescribing standards, specifications and quality assurance requirements for products procured by Indian Railways. Vendors supplying products that fall under the jurisdiction of RDSO are required to obtain approval in accordance with the procedures prescribed by RDSO before becoming eligible to participate in procurement for applicable items. Over the years, the vendor approval framework has evolved from a predominantly manual registration process into a structured, digitally enabled and lifecycle-based quality management system, with greater emphasis on transparency, standardisation and continuous quality assurance.

Evolution of the RDSO Vendor Approval Framework

Year	Regulatory / Policy Development	Key Change Introduced	Impact on Vendors
2018 ¹⁸	Launch of the New Online Vendor	Introduced online submission of vendor registration applications, year-round registration, online fee	Simplified the vendor registration process by reducing manual

¹⁷ https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0,5,268

¹⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1515999®=48&lang=2>

	Registration System (OVRs)	payment, application tracking, parallel document scrutiny, factory verification and publication of Expressions of Interest (EOIs).	documentation, improving transparency and enabling vendors to track applications electronically.
2019 ¹⁹	Strengthening of Vendor Development Initiatives	RDSO organised Vendor Meets, expanded Expressions of Interest (EOIs) and introduced measures to encourage participation from additional manufacturers, particularly for products having limited approved sources.	Increased participation by new manufacturers and MSMEs, strengthened indigenous manufacturing and expanded the approved vendor base.
2025 ²⁰	Strengthening of the Quality Management System (QMS)	Updated the Quality Order (QO-D-8.I Series) governing vendor registration, application processing, prototype and sample testing, vendor development, quality audits, product development, changes in vendor entity and changes in vendor approval status.	Introduced a more structured and standardised lifecycle-based approach to vendor approval and post-approval quality management across RDSO technical directorates.
Current Framework ²¹	Digital Vendor Approval through UVAM	Vendor registration and approval applications are processed electronically through the Unified Vendor Approval Module (UVAM) integrated with the Indian Railways E-Procurement System (IREPS) .	Improved transparency, standardised application processing and enabled end-to-end digital interaction between vendors and RDSO throughout the approval lifecycle.

Current Regulatory Framework ²²

The present vendor approval framework is governed through the **RDSO Quality Management System (QMS)** and the associated **Quality Order (QO-D-8.I Series)**, which collectively prescribe the

¹⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1583211®=48&lang=2>

²⁰ https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0,5,268

²¹ RDSO Vendor Registration https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0,5,268
IREPS <https://www.ireps.gov.in>

²² https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0,5,268

procedures governing vendor registration, application processing, prototype and sample testing, quality audits, vendor development, product development, changes in vendor entity, and changes in vendor approval status. Together, these Quality Orders establish a standardised governance framework that is applicable across RDSO technical directorates, thereby promoting consistency in vendor evaluation and quality assurance practices.

Latest Approval Mechanism²³

The vendor approval process is presently administered through the Unified Vendor Approval Module (UVAM) integrated with the Indian Railways E-Procurement System (IREPS). Under the current framework, vendors submit applications electronically, upload supporting documents, respond to observations online and monitor the status of their applications through a common digital platform. Depending on the product category, the approval process may include document scrutiny, technical evaluation, capability assessment, prototype or sample testing, factory verification and approval by the designated authority prior to inclusion in the approved vendor list. Following approval, vendors continue to remain subject to surveillance, quality audits and periodic review in accordance with the applicable Quality Orders.

Key Changes in the Current Framework²⁴

Earlier Framework	Current Framework	Impact on Vendors
Predominantly manual registration process	End-to-end online registration through UVAM	Reduced paperwork, improved processing efficiency and enhanced transparency.
Sequential processing of applications	Integrated digital workflow with electronic document submission and application tracking	Improved visibility and reduced administrative burden for applicants.
Registration-focused approach	Lifecycle-based quality management covering registration, approval, surveillance and post-approval compliance	Vendors are required to maintain ongoing compliance with prescribed quality and technical requirements even after approval.
Product-specific procedural practices	Standardised Quality Order (QO-D-8.1 Series) applicable across technical directorates	Greater consistency and uniformity in vendor evaluation and approval procedures.
Limited industry outreach	Vendor Meets and Expressions of Interest (EOIs) to broaden participation	Enhanced opportunities for new manufacturers and expansion of the approved vendor base.

²³ RDSO Vendor Registration https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0.5.268
IREPS <https://www.ireps.gov.in>

²⁴ https://rdso.indianrailways.gov.in/view_section.jsp?lang=0&id=0.5.268

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<https://pib.gov.in/PressReleasePage.aspx?PRID=158321>

MS Pipes

Overview of MS pipes and Tubes

Mild Steel (MS) pipes and tubes form a critical backbone of global infrastructure and industrial ecosystems. They are manufactured from low-carbon steel, making them highly malleable, weldable, and cost-efficient compared to alloy or stainless-steel pipes. Owing to these characteristics, MS pipes and tubes find widespread use across construction, engineering, automotive, water supply, sewage, oil & gas, and agriculture. Their versatility allows them to be used for structural purposes (such as in scaffolding, building frameworks, and bridges) as well as fluid transmission (water, gas, and oil pipelines).

The global market for MS pipes and tubes has been witnessing steady growth, driven by strong demand from real estate development, rapid urbanization, expanding industrial corridors, and large-scale infrastructure investments. With increasing focus on smart cities, transport networks, energy projects, and water supply schemes, the demand trajectory is expected to remain positive. Additionally, MS pipes enjoy a cost advantage over substitutes like plastic or stainless steel in applications where high corrosion resistance is not a priority, making them the preferred choice in price-sensitive markets.

At the same time, the sector is evolving under the influence of stricter environmental regulations, sustainability imperatives, and rising raw material costs. Manufacturers are increasingly adopting energy-efficient processes and recycled steel usage to reduce their carbon footprint. The oil & gas sector, logistics and warehousing expansion, and engineering applications are further adding to the growth momentum. Overall, MS pipes and tubes occupy a strategically vital position worldwide, bridging infrastructure needs with cost-effective and durable solutions.

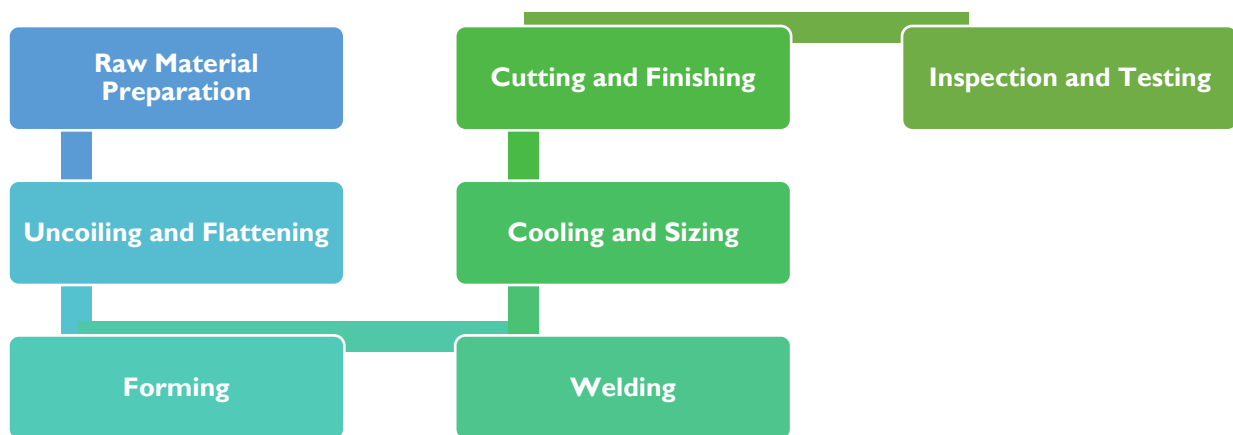
Types of MS pipes, key applications areas based in their diameters

Category	Diameter Range (Nominal Bore / Nominal Diameter (DN))	Key Application Areas
Small Diameter Pipes	½ inch – 2 inches / (DN 15–50 mm)	- Plumbing & water supply -Gas lines & HVAC systems -Firefighting networks- General engineering
Medium Diameter Pipes	3 inch – 6 inches / (DN 80–150 mm)	- Industrial fluid transport (oil, water, chemicals) - Irrigation & agriculture- Structural use (scaffolding, fencing) - Boilers & heat exchangers

Large Diameter Pipes	8 inch – 16 inches / (DN 200–400 mm)	- Water mains & distribution - Sewerage & effluent disposal - Oil & gas pipelines- Structural piles & civil works
Extra-Large Diameter Pipes	18 inch – 36 inch+ / (DN 450–900 mm+)	- Long-distance oil, gas & water pipelines - Infrastructure (bridges, ports, offshore) - Power plant piping- Culverts & underground casing

Insight on its manufacturing process

Mild Steel (MS) pipes are widely used across industries due to their durability, machinability, and cost-effectiveness. Their manufacturing involves a series of carefully controlled processes to ensure quality, uniformity, and compliance with standards. The process can be explained as follows:



➤ **Raw Material Preparation:**

The manufacturing of MS pipes begins with the selection and procurement of high-quality hot-rolled steel coils or sheets, which serve as the base raw material. These coils are made from low-carbon mild steel, known for its excellent ductility and weldability, making it suitable for pipe formation. The steel is carefully inspected to ensure it meets the required chemical and mechanical properties before entering the production line. This step forms the foundation for consistent pipe quality.

➤ **Uncoiling and Flattening:**

Once the raw material is ready, the steel coils are uncoiled and straightened into flat sheets or strips using special uncoiling and levelling machines. This process eliminates bends or irregularities that may affect the forming stage. The flattened strips are then precisely cut to the required width, ensuring uniformity before they are fed into the pipe mill. Maintaining accuracy here is crucial as it impacts the pipe's dimensional accuracy in the later stages.

➤ **Forming:**

The prepared steel strips are gradually shaped into cylindrical forms through a series of forming rolls. These rolls bend the flat strip progressively until it takes a complete round shape, with its edges closely aligned for welding. The forming process is carefully controlled to prevent cracks, uneven thickness, or misalignment. At this stage, the pipe resembles a tube but is not yet fully joined.

➤ **Welding:**

After forming, the aligned edges of the cylindrical strip are welded together to create a continuous pipe. In the Electric Resistance Welding (ERW) process, high-frequency electric currents generate heat at the edges, fusing them without the need for filler materials. This results in a strong, seamless longitudinal weld. The welded seam is then trimmed and inspected to ensure smoothness and structural integrity.

➤ **Cooling and Sizing:**

Immediately after welding, the pipe undergoes controlled cooling to stabilize its structure. It is then passed through sizing and reducing rolls, which refine its outer diameter, wall thickness, and roundness according to precise specifications. This step ensures that the pipe meets dimensional tolerances and customer requirements.

➤ **Cutting and Finishing:**

The pipes are produced in continuous lengths and then cut into specific sizes using flying cutoff machines, which allow cutting without interrupting the production flow. Once cut, the pipes undergo finishing processes such as bevelling, end-threading, galvanizing, painting, or varnishing, depending on the intended application. These treatments enhance corrosion resistance, durability, and ease of installation.

➤ **Inspection and Testing:**

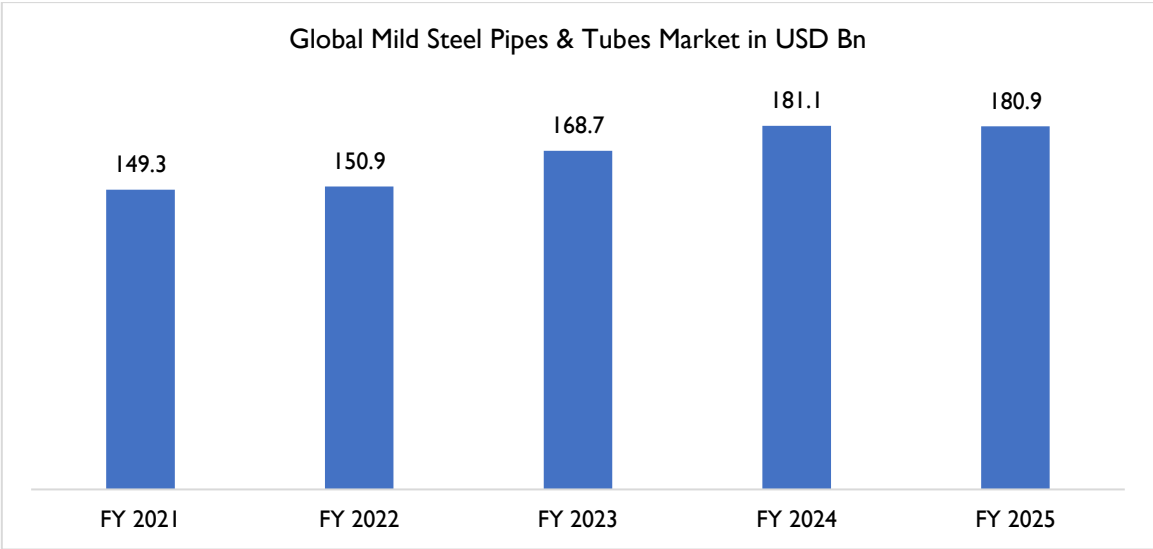
The final stage involves rigorous inspection and testing to ensure the pipes meet national and international quality standards. Common tests include hydrostatic testing for leakage, bend and flattening tests for flexibility, and dimensional checks for uniformity. Non-destructive testing methods, such as ultrasonic or X-ray inspection, are also applied to detect any internal defects in the weld seam. Only pipes that pass all quality checks are approved for dispatch.

Major Raw material used in MS pipe Manufacturing



Global MS Pipes Market Scenario

The Global Mild Steel Pipes & Tubes market has demonstrated a stable growth trajectory, increasing from USD 149.3 billion in FY 2021 to a projected USD 180.9 billion by FY 2025. This growth reflects a sustained demand for mild steel products driven by infrastructure expansion, industrial development, and construction activities worldwide. As a cost-efficient and highly adaptable material, mild steel pipes and tubes continue to play a central role in energy, transportation, water supply, and structural applications across both developed and emerging economies.



Source: Primary Research, D&B Analysis

The market’s growth was supported by large-scale industrialization and construction projects in Asia-Pacific, particularly China and India, where rapid urbanization and government-led infrastructure programs drove consumption. North America and Europe also contributed steadily, with investments in energy pipelines, urban redevelopment, and green construction projects. The availability of low-cost raw materials and advances in manufacturing technologies further strengthened supply capabilities, ensuring consistent market expansion over the observed period.

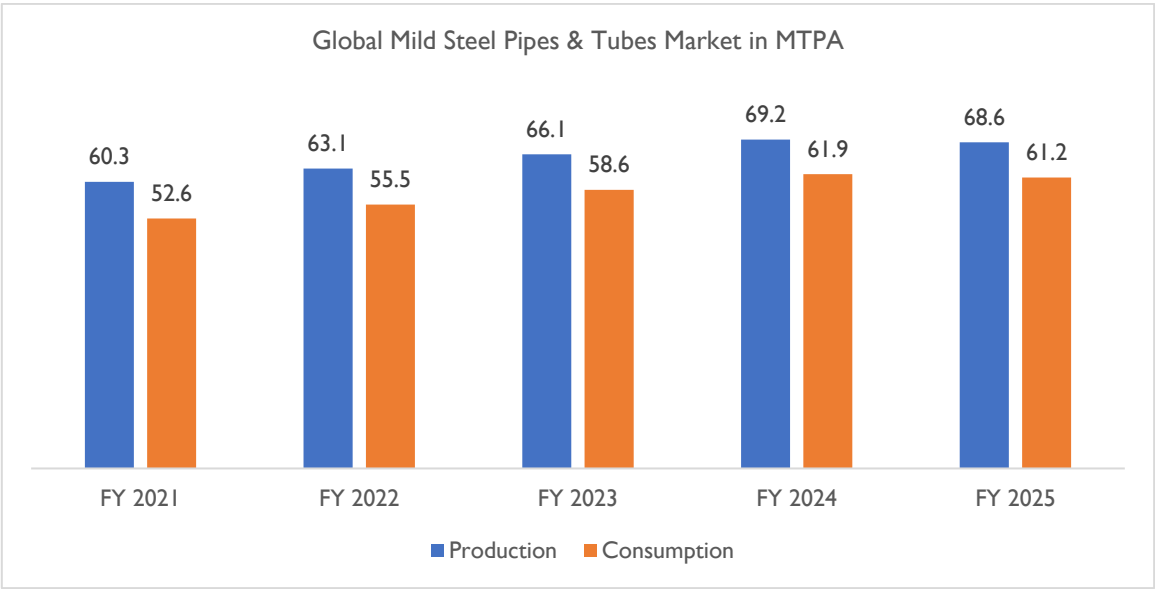
Additionally, utility and infrastructure upgrades across developing regions including water distribution networks, renewable energy support structures, and rural electrification projects added to the demand momentum. Unlike the past decade when growth was concentrated in industrialized regions, the current phase reflects a balanced global spread of demand. This demonstrates the increasing integration of mild steel pipes and tubes into diverse applications worldwide, solidifying their position as a backbone material in global industrial and infrastructure growth.

Annual Production and Consumption of Global MS Pipe Production

The global mild steel pipes and tubes industry plays a critical role in enabling infrastructure, energy transport, water supply, and industrial processing across both developing and developed economies. As a foundational component in sectors such as oil & gas, construction, automotive, and utilities, the market’s production and consumption trends are closely tied to macroeconomic cycles, capital investments, and regional industrial policies.

The period from FY 2021 to FY 2025 reflects a phase of post-pandemic recovery, stabilization, and gradual restructuring in global supply chains. The following overview examines production and consumption dynamics during this period, highlighting key regional developments, growth patterns, and underlying drivers. Between FY 2021 and FY 2025, global production of mild steel pipes and tubes rose from **60.3 million tonnes** to **68.6 million tonnes**, marking a CAGR of **3.3%**, while consumption increased from **52.6 million tonnes** to **61.2 million tonnes**, growing at a slightly higher CAGR of **3.9%**.

This steady growth reflects the normalization of industrial activity post-COVID and increasing demand from infrastructure rehabilitation, municipal pipeline upgrades, and manufacturing expansions. Importantly, the narrowing gap between production and consumption over this period indicates greater demand-supply alignment, improving operational efficiencies across global markets and reducing surplus capacity pressures.



Source: Primary Research, D&B Analysis

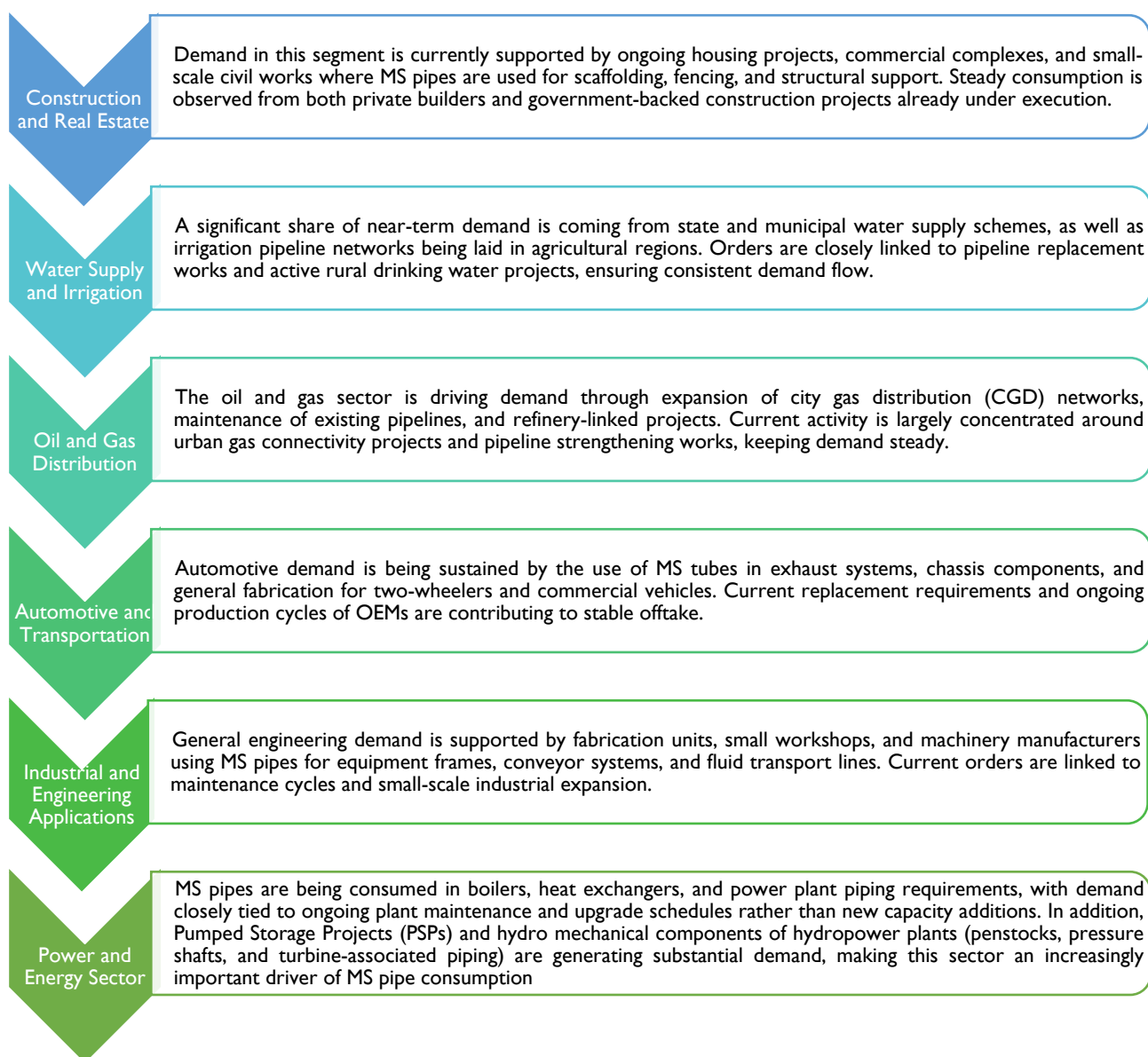
Asia-Pacific continued to dominate both production and consumption, driven by strong industrial bases in China and India. China’s domestic consumption remained stable despite moderating construction growth, while India’s demand surged due to large-scale government investment in roads, railways, and water infrastructure. Vietnam and Indonesia also saw increased demand due to expanding manufacturing footprints. In the Middle East, pipeline infrastructure expansion, especially in UAE, Saudi Arabia, and Qatar, sustained demand growth. These developments made Asia and the Gulf key consumption hubs during the period.

In Europe, while consumption grew moderately due to infrastructure modernization and green building initiatives, production faced structural constraints. High energy costs, stricter carbon regulations, and industry consolidation limited supply growth. North America saw sustained demand from sectors like oil & gas, commercial construction, and municipal water systems, particularly in the U.S., where infrastructure stimulus packages played a crucial role. However, local producers contended with challenges such as supply chain bottlenecks and rising production costs, affecting competitiveness and output volumes.

Africa and Latin America exhibited slower yet consistent consumption growth, with rising demand in water infrastructure, agriculture, and power distribution. Countries such as Nigeria, Kenya, and South Africa reported increasing use of mild steel pipes for irrigation and water delivery, while Brazil and Argentina gradually revived public works spending. However, due to limited manufacturing capabilities, these regions remained largely import-dependent. Initiatives to localize pipe production through new facilities and foreign investment are still in early stages but signal long-term potential for supply diversification.

Overall, the period FY 2021–25 marked a phase of cautious recovery and incremental growth in the global mild steel pipes and tubes market. The stronger CAGR in consumption compared to production reflects robust end-use demand, particularly in emerging markets and energy-intensive sectors. Looking ahead, the focus will likely shift toward technology integration, sustainability, and regional capacity expansion to support rising infrastructure and utility demands. With ongoing geopolitical shifts and energy transitions reshaping global steel trade flows, the mild steel pipe industry is expected to evolve with more localized supply chains and product specialization, reinforcing its importance in global infrastructure development.

Major demand trend from key user segments

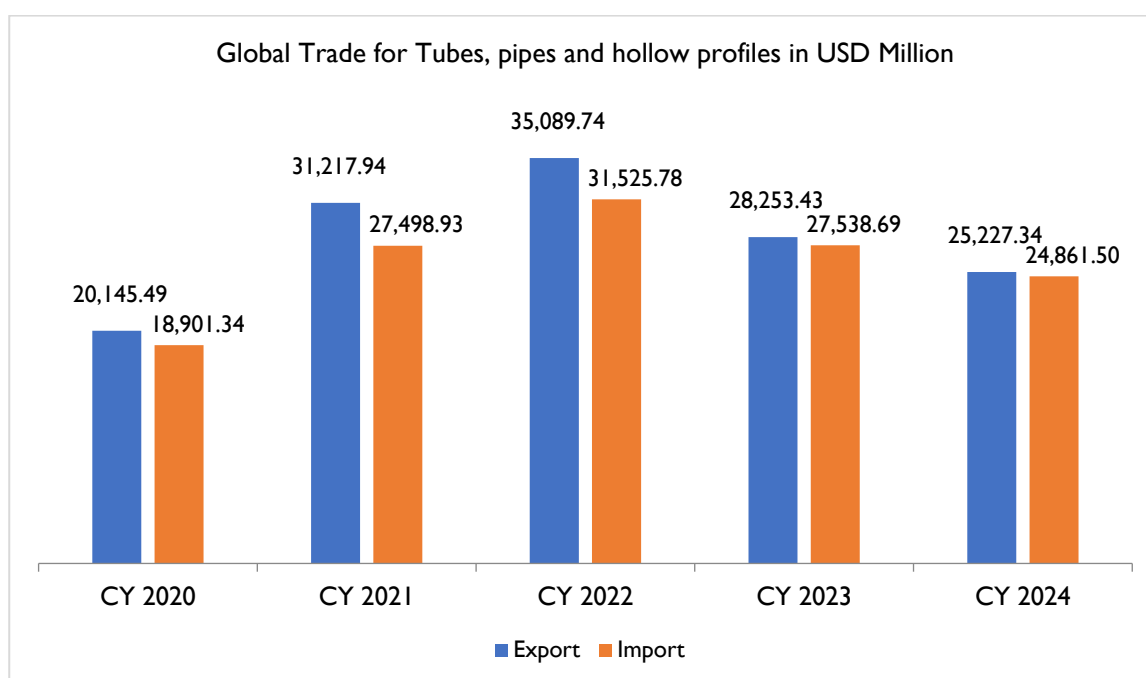


Overall, the demand for MS pipes in India remains steady across diverse user segments, supported by active projects and short-term operational needs rather than long-cycle investments. Construction, water supply, and gas distribution continue to generate consistent consumption, while automotive, power, and general engineering applications sustain a reliable baseline demand. This balanced spread across industries reinforces the role of MS pipes as a dependable material in day-to-day infrastructure, utilities, and manufacturing requirements.

Global trade scenario

Historical Export and Import Trend

The global trade of tubes, pipes, and hollow profiles, including MS pipes, has experienced notable shifts in recent years, shaped by fluctuations in industrial demand, construction activity, and international trade dynamics. After witnessing strong growth during the post-pandemic recovery period, driven by infrastructure expansion and manufacturing revival, the market has more recently seen a slowdown as global demand softened and countries pursued greater self-reliance in steel-based products. This trend highlights both the cyclical nature of the sector and the impact of broader economic and policy changes on the movement of MS pipes across international markets.



Source ²⁵: International Trade Centre

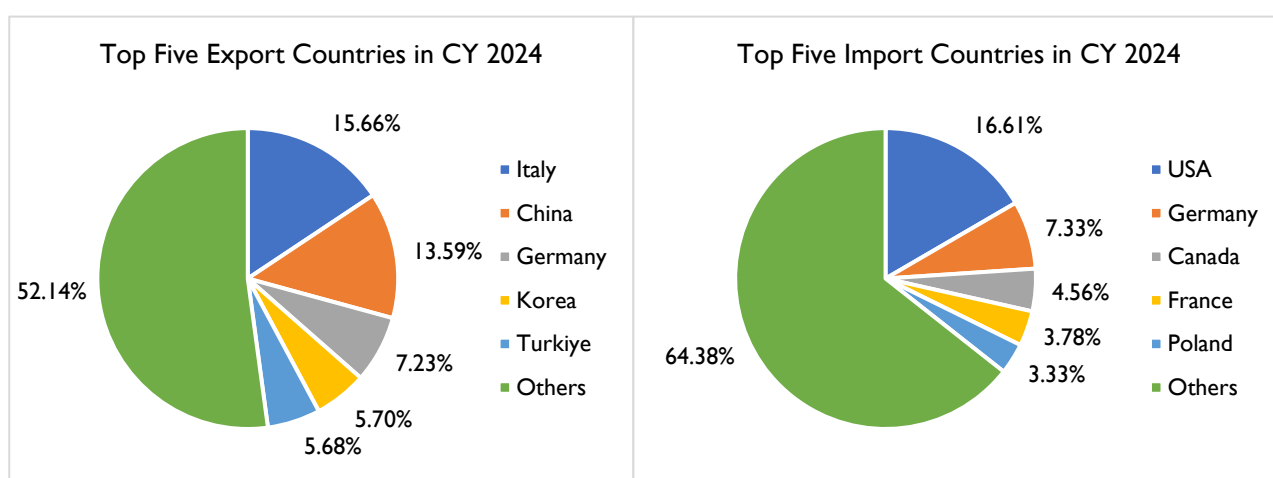
The global trade of tubes, pipes, and hollow profiles, a broader category that includes MS (Mild Steel) Pipes, has shown considerable fluctuations between CY 2020 and CY 2024. Exports rose sharply from USD 20,145.49 million in 2020 to USD 31,217.94 million in 2021, further peaking at USD 35,089.74 million in 2022. Imports followed a similar growth pattern, increasing from USD 18,901.34 million in 2020 to USD 27,498.93 million in 2021 and USD 31,525.78 million in 2022. This strong trade expansion during 2021–2022 reflects the post-pandemic recovery in global construction, infrastructure development, and industrial activity, where MS pipes and tubes are key materials.

²⁵ HS Code – 7306 Tubes, pipes and hollow profiles "e.g., open seam or welded, riveted or similarly closed", of iron or steel (excl. of cast iron, seamless tubes and pipes and tubes having internal and external circular cross-sections and an external diameter of > 406,4 mm)

However, from CY 2023 onwards, both exports and imports showed a visible decline. Exports fell to USD 28,253.43 million in 2023 and further dropped to USD 25,227.34 million in 2024, while imports contracted to USD 27,538.69 million in 2023 and USD 24,861.50 million in 2024. This downturn points to a slowdown in global demand and trade activity for MS pipes and related steel products, possibly due to softer commodity markets, tighter trade regulations, and reduced project investments in certain geographies.

Overall, while the 2021–2022 period highlighted robust trade growth in MS pipes and related tubular products, the subsequent years indicate moderation, with exports and imports nearly converging in 2024. This reflects not only a contraction in global steel consumption but also increasing self-reliance and capacity building in several countries, which has influenced trade balances in this category.

Insight on top five trading countries



Source: International Trade Centre

Top Five Export Countries- CY 2024

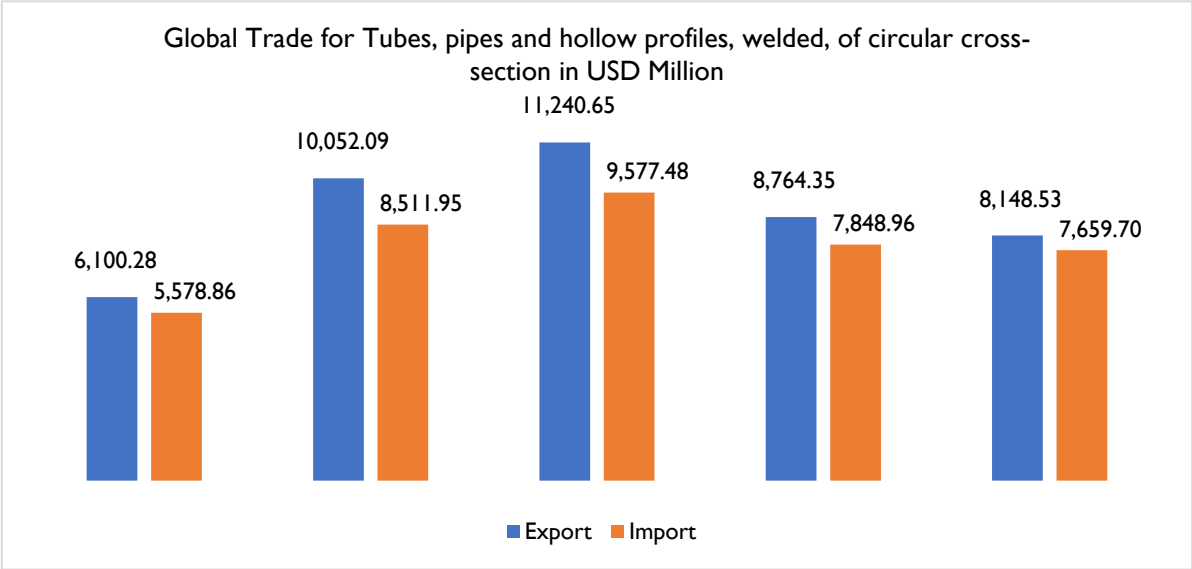
In CY 2024, Italy led global exports of tubes, pipes, and hollow profiles (broader MS pipes category) with USD 3,949.66 million (15.66%), followed by China at USD 3,427.85 million (13.59%). Germany stood third with USD 1,824.64 million (7.23%), while Korea and Turkiye were nearly equal contributors at USD 1,438.13 million (5.70%) and USD 1,433.00 million (5.68%), respectively. Collectively, these top five countries accounted for close to half of global exports, while the “Others” category dominated with USD 13,154.06 million (52.14%), highlighting the diversified and geographically spread nature of MS pipes trade across multiple regions.

Top Five Import Countries- CY 2024

On the import side, the USA emerged as the largest market in CY 2024 with USD 4,130.49 million (16.61%), driven by high demand from infrastructure, oil & gas, and industrial sectors. Germany followed with USD 1,822.94 million (7.33%), despite also being a major exporter, reflecting its dual role in the global trade network. Canada imported USD 1,134.29 million (4.56%), while France and Poland recorded USD 940.68

million (3.78%) and USD 827.21 million (3.33%), respectively. Together, these top five countries accounted for over one-third of total imports, while “Others” made up the bulk share at USD 16,005.89 million (64.38%), indicating widespread and decentralized demand for MS pipes worldwide.

Historical Export and Import Trend



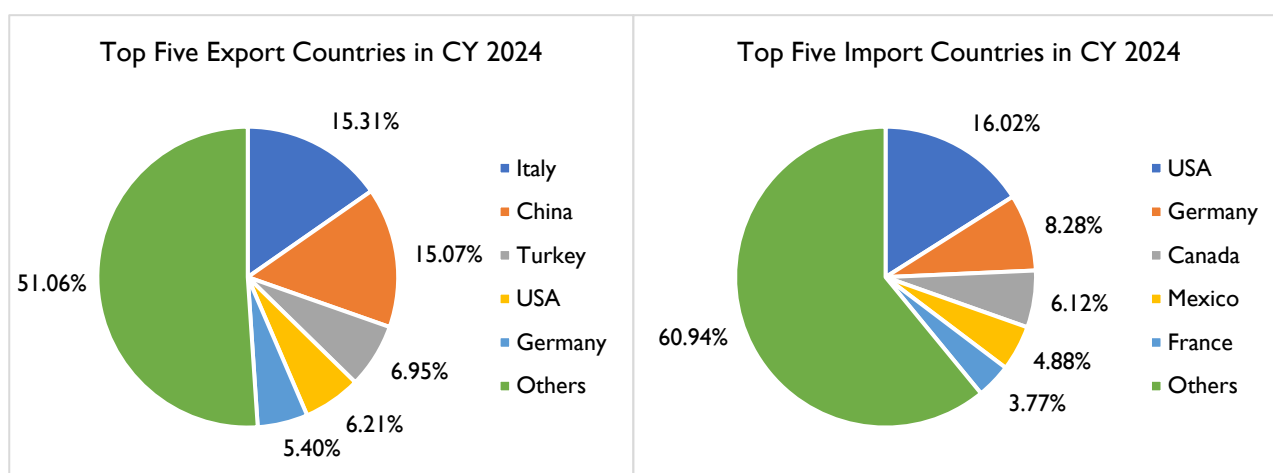
Source ²⁶: International Trade Centre

The global trade for welded tubes, pipes, and hollow profiles of circular cross-section demonstrates a consistently strong performance, with exports surpassing imports across all observed periods. Exports rose from USD 6,100.28 million to a peak of USD 11,240.65 million before moderating to USD 8,148.53 million, while imports followed a similar trend, increasing from USD 5,578.86 million to a high of USD 9,577.48 million before easing to USD 7,659.70 million.

This indicates that while global demand remains significant, the market has experienced a cycle of rapid growth followed by a correction phase. The persistent export surplus highlights the sector’s strong production capacity, though the narrowing trade gap suggests that importing countries are gradually strengthening their domestic manufacturing or reducing reliance on foreign supply. Overall, the trade pattern reflects robust global demand linked to infrastructure and industrial growth, tempered by recent adjustments likely influenced by economic conditions, policy changes, or raw material fluctuations.

²⁶ HS Code – 730630 Tubes, pipes and hollow profiles, welded, of circular cross-section, of iron or non-alloy steel (excl. products having internal and external circular cross-sections and an external diameter of > 406,4 mm, or line pipe of a kind used for oil or gas pipelines or casing and tubing of a kind used in drilling for oil or gas)

Insight on top five trading countries



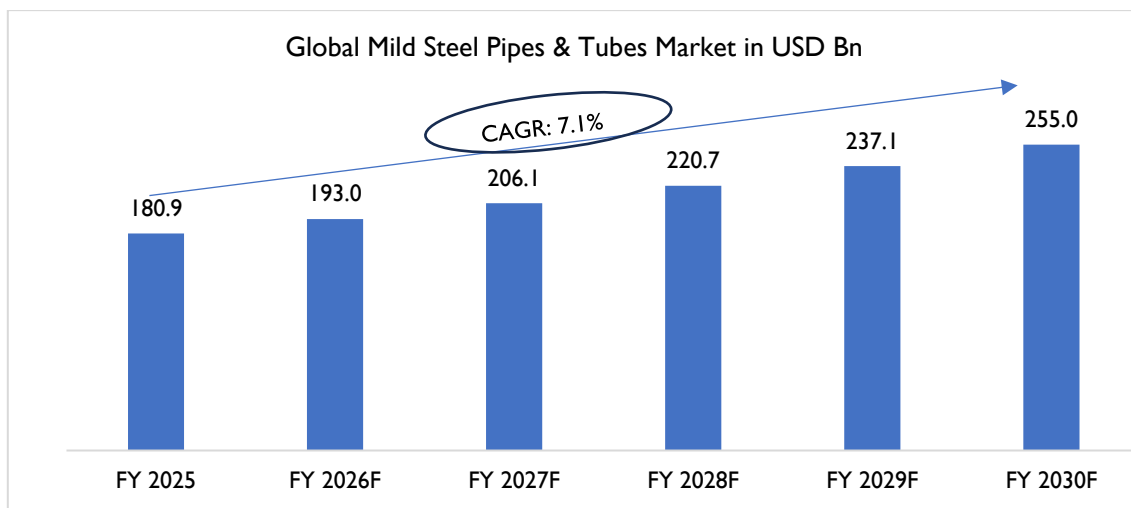
Source: International Trade Centre

In 2024, the global trade of welded tubes, pipes, and hollow profiles shows a clear contrast between concentrated exports and dispersed imports. On the export side, Italy and China together dominates with over 30% share, supported by its large-scale steel production capacity, cost competitiveness, and government-backed manufacturing strength. Turkey, the USA, and Germany also contribute, but more than half of exports (51.06%) come from other countries, reflecting a fragmented supply base beyond China.

On the import side, the USA leads with 16.02%, driven by high infrastructure spending and reliance on foreign supply, followed by Germany, Canada, Mexico, and France. However, 60.94% of imports are spread across other markets, showing broad-based demand linked to construction, energy, and industrial activities worldwide. Overall, while China is the central hub for supply, imports are diversified, underscoring global dependence on Chinese exports alongside widespread consumption needs.

Growth forecast: Expected growth in demand

The Global Mild Steel Pipes & Tubes market is expected to grow significantly from USD 180.9 billion in FY 2025 to USD 255.0 billion by FY 2030F. This projected expansion highlights a robust CAGR over the five-year period, fuelled by increasing industrialization, urban infrastructure upgrades, and rising global demand for cost-effective and versatile construction materials. Mild steel pipes and tubes continue to be integral across multiple industries, serving as critical inputs in construction, energy, manufacturing, water supply, and transportation projects worldwide.



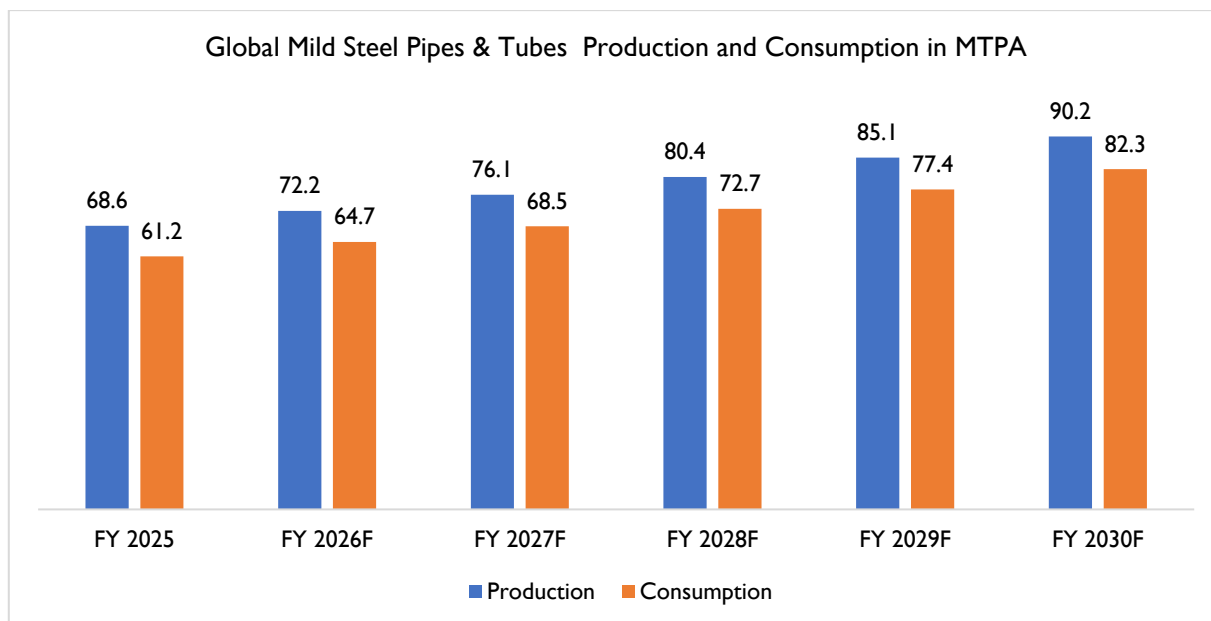
Source: Primary Research, D&B analysis

This growth is primarily driven by large-scale infrastructure modernization across emerging economies, where expanding urban centers, affordable housing projects, and industrial corridors are increasing demand for steel-based construction materials. Simultaneously, developed regions are contributing through investments in sustainable urban development, renewable energy projects, and the refurbishment of aging pipeline and utility systems. The push for efficient, durable, and economical materials ensures that mild steel pipes and tubes remain a preferred choice over alternatives.

Furthermore, the growing emphasis on renewable energy and green infrastructure is creating new opportunities for the use of mild steel in support structures for solar, wind, and hydro projects. Utility expansion in rural and semi-urban areas, particularly in Asia-Pacific and Africa, will further fuel demand for water supply networks, irrigation systems, and power distribution lines. This broader diversification of applications and geographic spread underscores the role of mild steel pipes and tubes as a backbone of global industrial and infrastructure growth in the coming decade.

Production & Consumption Overview:

Global production is projected to increase from 68.6 million tonnes in FY 2025 to 90.2 million tonnes by FY 2030, at a CAGR of 5.6%. Meanwhile, consumption is anticipated to grow from 61.2 million tonnes to 82.3 million tonnes during the same period, at a slightly higher CAGR of 6.1%, indicating strong end-use market pull and narrowing trade gaps.



Source: Primary Research, D&B analysis

The projected 7.1% CAGR in market value outpacing the volume growth (5.6% for production and 6.1% for consumption) highlights an important trend: the global mild steel pipes and tubes market is not only expanding in quantity but also evolving in quality and pricing. This divergence indicates an increasing demand for value-added products such as coated, precision, or customized tubes used in specialized applications like automotive, construction machinery, and energy transmission. Additionally, rising input costs, including iron ore, energy, and logistics, are likely to contribute to a higher average selling price (ASP) across the forecast period, further inflating market value.

The relatively faster growth in consumption compared to production suggests a gradual narrowing of the supply-demand gap. This implies that demand centers especially in emerging economies in Asia, Africa, and parts of Latin America are ramping up their usage of steel tubes faster than their domestic output, potentially creating new trade opportunities or investments in local production. At the same time, developed markets like North America and Europe may witness slower volume growth but a significant shift toward high-specification and sustainable products, backed by stricter regulatory standards and industrial upgrades.

Moreover, with the global push toward infrastructure modernization, energy transition (such as pipelines for hydrogen and natural gas), and clean mobility, the industry is likely to witness a transformation in product requirements and supply chain dynamics.

Evolving factor shaping the industry growth in future

- Expanding End-Use Industries:** The demand for MS pipes is set to rise steadily, supported by the expansion of construction, water management, and chemical industries. Rapid urbanization and population growth are increasing the need for housing, commercial spaces, and civic infrastructure, making MS pipes an essential component in structural frameworks and utility networks. Econometric

market assessments also highlight that as cities expand, the requirement for steel-based infrastructure such as water pipelines, bridges, and industrial plants will grow significantly, creating a strong base of long-term demand.

- **Technological Advancements:** Advances in manufacturing technology are expected to reshape the MS pipes market by improving efficiency and reducing production costs. Automation, precision engineering, and advanced coating or galvanizing methods enhance pipe durability and performance across applications. These innovations not only lower operational costs but also provide affordable, higher-quality solutions to end-users in construction, automotive, and chemical sectors. As a result, technological progress will play a central role in ensuring sustained market competitiveness and penetration into diverse industries.
- **Pricing Dynamics and Cost Structures:** Raw material costs remain the primary determinant of MS pipe pricing, with fluctuations in global iron ore markets directly influencing construction-grade tube prices. Application-specific requirements further shape cost variations; for example, the precision needed in automotive exhaust systems can raise production expenses by 12–18%, while simpler galvanized pipes for agricultural irrigation remain comparatively affordable.

Regional energy costs also impact competitiveness, with high European electricity prices driving Middle Eastern buyers to import from South Asia. Additionally, logistics and processing complexities add further layers to pricing shipping a 40-foot container from China to Brazil costs around \$4,200, while specialized treatments like zinc galvanizing or pre-painting increase product premiums in chemical and automotive applications.

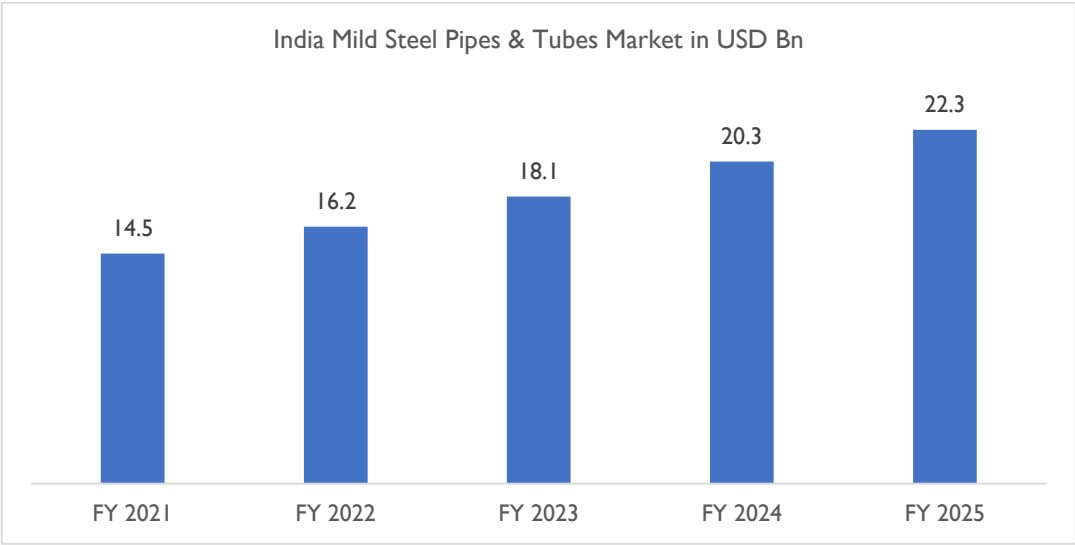
- **Regulatory and Geopolitical Influences:** The MS pipes market is also shaped by regulatory and geopolitical factors, which directly influence cost structures and demand patterns. More stringent environmental laws are expected to increase compliance and production costs, compelling manufacturers to adopt cleaner, more sustainable practices. At the same time, geopolitical tensions, shifting trade policies, and disruptions in supply chains affect the availability of raw materials and the flow of goods across markets. These uncertainties can lead to pricing fluctuations, supply shortages, or regional imbalances, making risk management a key strategic priority for industry players.

Looking ahead, the MS pipes market is positioned for stable growth, backed by large-scale infrastructure projects, urban development, and ongoing technological improvements. However, challenges such as raw material volatility, stringent environmental regulations, and rising logistics costs may create hurdles for producers and distributors.

MS pipes industry in India

Annual Production & Consumption of MS Pipes & Tubes in India & historical growth trends

The India Mild Steel Pipes & Tubes market has been on a steady growth path, expanding from USD 14.5 billion in FY 2021 to an expected USD 22.3 billion by FY 2025. This growth trend highlights the sector’s resilience and rising significance within India’s industrial and infrastructure ecosystem. Mild steel pipes and tubes, being cost-effective and versatile, are increasingly used in construction, manufacturing, water supply, energy, and agricultural applications, making them a vital component of India’s development framework.



Source: Primary Research, D&B Analysis

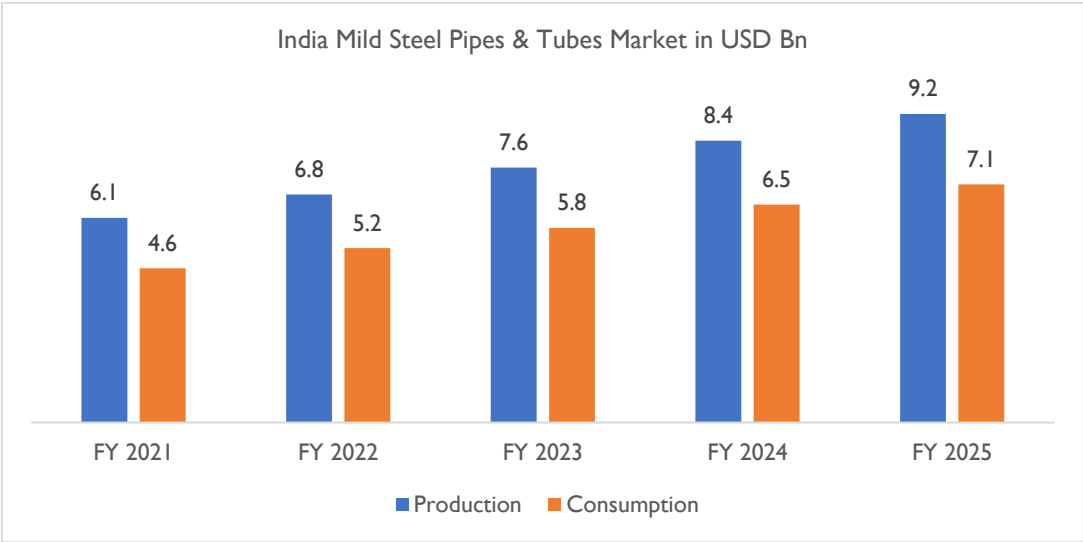
The market expansion was further fuelled by the rise of industrial activity in Tier II and Tier III cities, where improved access to finance, land, and transport infrastructure supported small and mid-sized enterprises. This regional industrial push reduced the over-dependence on metropolitan centers and enabled a more inclusive spread of demand. In addition, growing construction activities in emerging industrial hubs and enhanced investments in housing, commercial real estate, and industrial parks amplified the demand for mild steel pipes and tubes.

Government policies have been the biggest catalyst behind this surge. The Jal Jeevan Mission (2019) created massive incremental demand for MS pipes by driving nationwide expansion of rural drinking water networks, where pipelines form the backbone of service delivery. Similarly, the National Electricity Plans of 2018 and 2023 expanded requirements for MS pipes in transmission structures, power plants, and renewable energy projects. The Hydropower Policy (2019) further reinforced demand, with MS pipes being extensively deployed in penstocks, irrigation-linked hydro projects, and associated civil works. Collectively, these initiatives transformed MS pipes from a sectoral input into a critical enabler of national infrastructure, resulting in a sharp and sustained demand boost across water, energy, and industrial applications.

Utility infrastructure upgrades in rural and semi-urban regions, including irrigation networks, small-scale water supply lines, and renewable energy support structures, also played a crucial role in driving consumption. Unlike traditional metro-driven growth, this phase saw broader regional dispersion of demand, highlighting the evolving nature of India's industrial landscape. The rising adoption of mild steel pipes across diverse applications signifies both geographic penetration and sectoral diversification, making the industry a key enabler of India's future infrastructure and economic ambitions.

Annual Production & Consumption of MS Pipes & Tubes in India

India's mild steel pipes and tubes production increased from **6.1 million tonnes to 9.2 million tonnes**, registering a **CAGR of 10.8%** between FY 2021-25, while consumption rose from **4.6 million tonnes to 7.1 million tonnes**, reflecting a slightly faster CAGR of **11.5%**. This parallel growth indicates strong alignment between domestic capacity expansion and rising end-user demand. Notably, increased private investments in industrial estates, logistics corridors, and process industries (like food, chemical, and textiles) fuelled consistent offtake of mild steel tubes, especially in medium-pressure fluid transport and structural applications.



Source: Primary Research, D&B Analysis

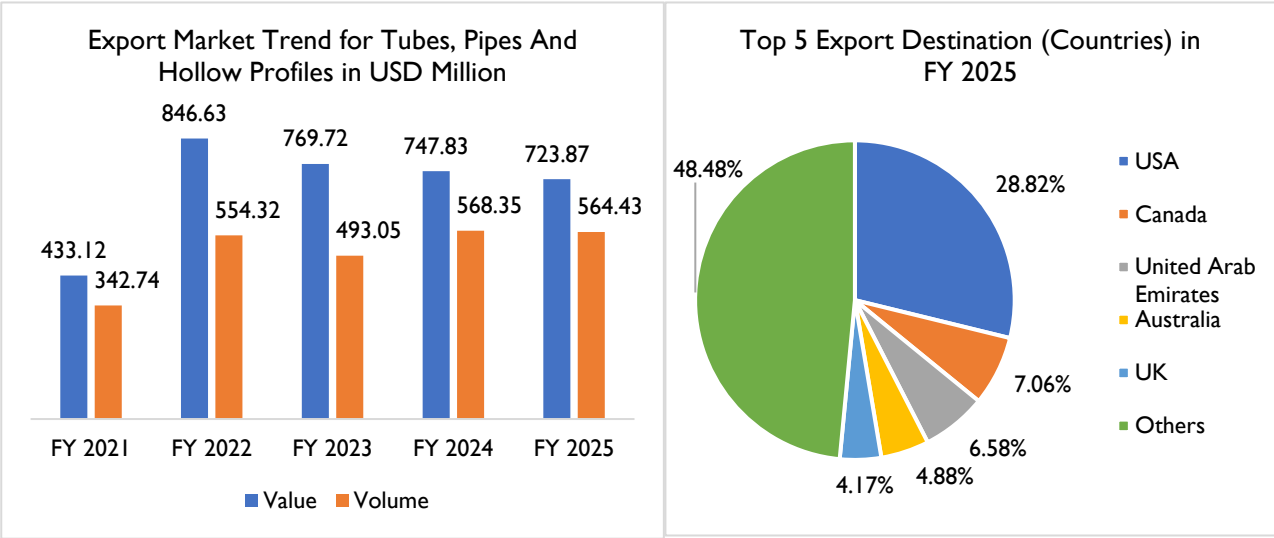
The consumption side was further supported by the adoption of mild steel pipes in various secondary applications like scaffolding systems, greenhouse structures, and material handling setups across SME and MSME segments. As small manufacturers pursued capacity upgrades, the demand for cost-effective yet durable structural components such as ERW (electric resistance welded) and GI (galvanized iron) pipes witnessed steady growth. Additionally, government efforts to modernize agri-water distribution and rural electrification also bolstered offtake in non-urban geographies, contributing to a wider geographic spread in consumption patterns.

From the production perspective, Indian pipe manufacturers increasingly adopted automated forming and welding technologies, enabling better yield and faster production cycles. This shift helped domestic players

not only match rising domestic demand but also improve product consistency and quality, reducing reliance on imports. Additionally, the introduction of BIS certification norms across various categories helped standardize production while encouraging investment in compliance-ready manufacturing units. Overall, India's mild steel pipe and tube market in this period displayed a healthy and scalable growth model, balancing demand pull and production readiness.

Foreign Trade trend in MS pipes & Tube

Export scenario Trend (last 5 years) for Tubes, Pipes And Hollow Profiles



Source ²⁷: Directorate General of Foreign Trade (DGFT)

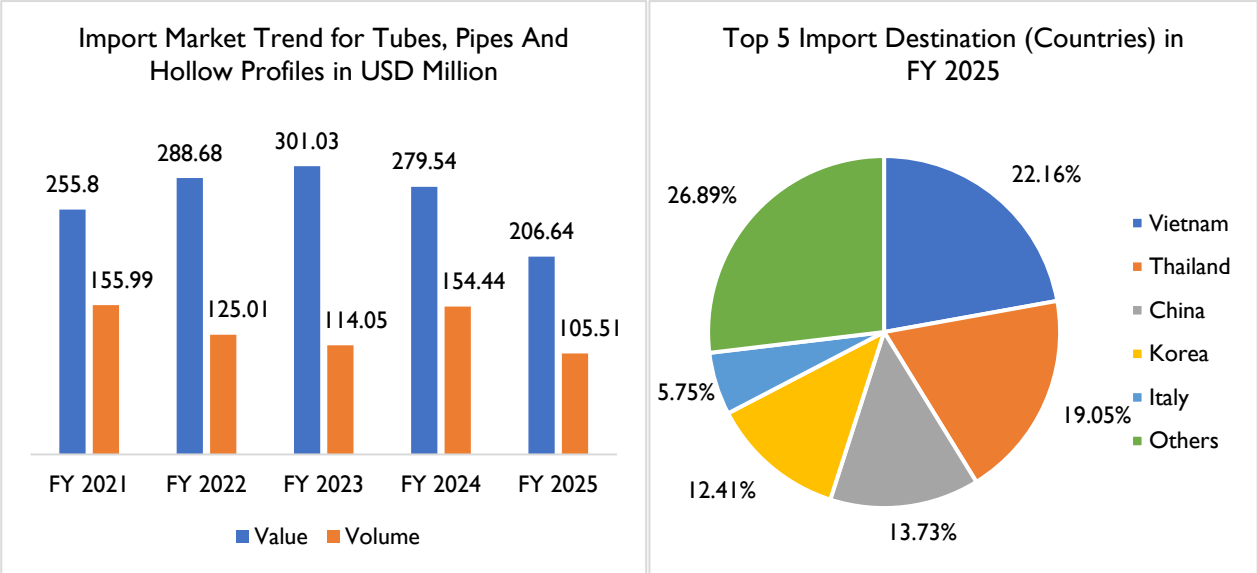
The export market for tubes, pipes, and hollow profiles has shown notable fluctuations between FY 2021 and FY 2025. Exports surged from USD 433.12 million in FY 2021 to a peak of USD 846.63 million in FY 2022, supported by higher global demand, favourable pricing, and recovery in post-pandemic industrial activity. However, subsequent years witnessed a gradual decline to USD 723.87 million in FY 2025, even though export volumes remained steady in the range of USD 493–568 million. This divergence suggests pricing pressures, higher competition, volatility in raw material costs, and possible changes in trade tariffs affecting overall value realization despite stable demand.

In terms of destinations, the USA dominated in FY 2025 with 28.82% of total exports (USD 208.62 million), followed by Canada, the UAE, Australia, and the UK. The top five markets together account for over 50% of exports, while nearly half (48.48%) is spread across “Others,” indicating both concentration in mature economies and growth opportunities in diversified regions. Dependence on the USA reflects strong bilateral trade ties and consistent demand from its construction and energy sectors, whereas Canada and the UAE benefit from infrastructure projects. Australia and the UK also contribute due to ongoing industrial

²⁷ Hs Code- 7306 (Other Tubes, Pipes And Hollow Profiles (For Example, Open Seam Or Welded, Riveted Or Similarly Closed), Of Iron Or Ste)

investments. Going forward, broader market diversification and competitive pricing strategies will be crucial to sustaining growth and reducing reliance on a single dominant market.

Import scenario Trend (last 5 years) for Tubes, Pipes And Hollow Profiles

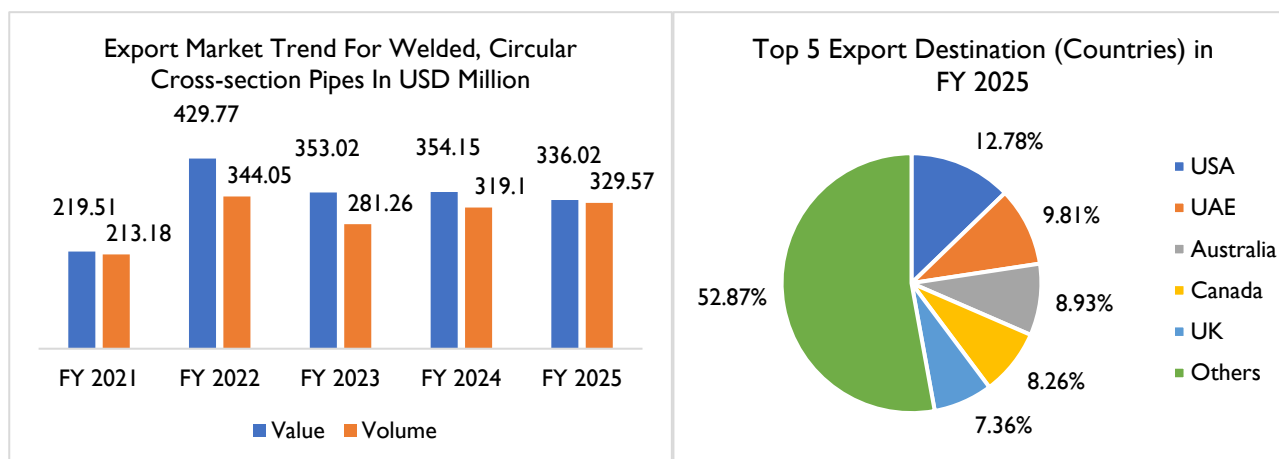


Source: Directorate General of Foreign Trade (DGFT)

The import market for tubes, pipes, and hollow profiles has experienced an inconsistent trend from FY 2021 to FY 2025. Imports rose from USD 255.8 million in FY 2021 to a peak of USD 301.03 million in FY 2023, reflecting higher domestic demand and reliance on foreign suppliers for specialized products. However, the value of imports gradually declined thereafter, falling sharply to USD 206.64 million in FY 2025. A similar pattern is seen in import volumes, which dropped from 155.99 million in FY 2021 to 105.51 million in FY 2025. This indicates that domestic production and substitution may have strengthened in recent years, coupled with reduced dependence on imports due to government support for local industries, higher tariffs, and cost competitiveness in local manufacturing.

In terms of import destinations, Vietnam emerged as the largest supplier in FY 2025 with USD 45.8 million (22.16%), followed by Thailand (USD 39.36 million; 19.05%), China (USD 28.38 million; 13.73%), Korea (USD 25.65 million; 12.41%), and Italy (USD 11.89 million; 5.75%). Collectively, the top five countries contributed nearly 73% of total imports, with “Others” accounting for 26.89% (USD 55.56 million). The dominance of Vietnam and Thailand highlights strong trade links in the Southeast Asian region, driven by competitive pricing and availability of mid-range quality products. China and Korea remain key players due to advanced manufacturing capabilities, while imports from Italy reflect niche, high-quality product demand. Overall, the decline in import dependency suggests a shift towards strengthening domestic capacity, though reliance on regional partners continues to play a significant role in bridging supply gaps.

Trade scenario Trend by value and volume (last 5 years) for welded, circular cross-section Pipes



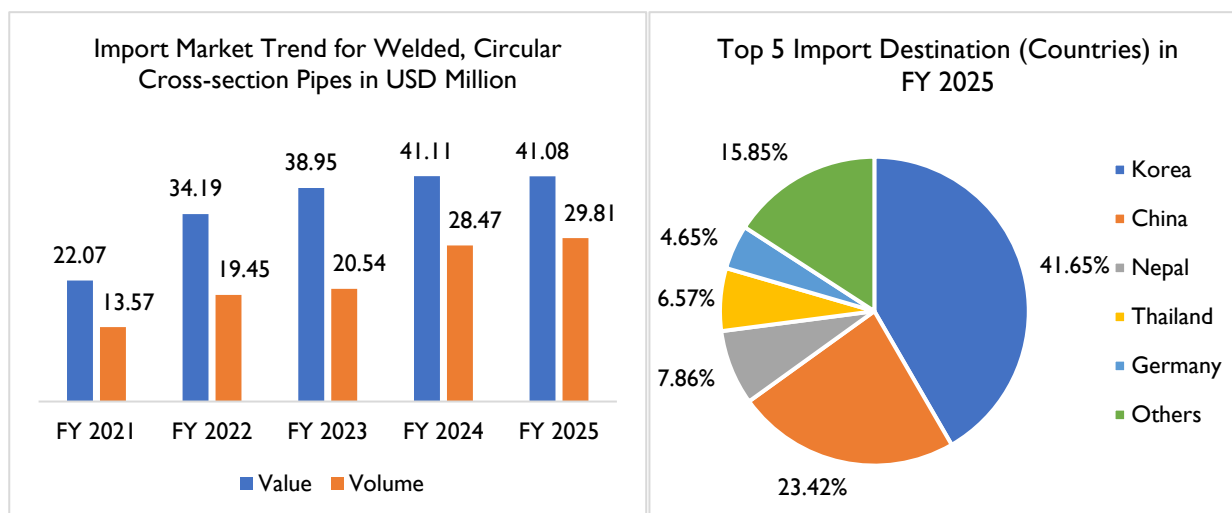
Source ²⁸: Directorate General of Foreign Trade (DGFT)

The export market for welded, circular cross-section pipes has shown steady yet fluctuating trends between FY 2021 and FY 2025. Exports increased sharply from USD 219.51 million in FY 2021 to a peak of USD 429.77 million in FY 2022, largely driven by strong global demand, post-pandemic infrastructure recovery, and favourable pricing. However, the following years witnessed moderation, with values stabilizing around USD 336–354 million during FY 2023–FY 2025. Export volumes followed a similar path, rising from 213.18 million in FY 2021 to 344.05 million in FY 2022, before settling near 319–329 million by FY 2025. This indicates that while global demand has sustained, the market has adjusted due to competition, pricing pressure, and normalization of trade after the initial surge.

In FY 2025, the USA emerged as the largest export destination, accounting for 12.78% of total exports (USD 42.95 million), followed by the UAE (9.81%), Australia (8.93%), Canada (8.26%), and the UK (7.36%). Collectively, these top five destinations contributed about 47.13% of exports, while “Others” represented the majority share at 52.87% (USD 177.64 million). This distribution highlights both a diversified export base and significant reliance on multiple smaller markets worldwide. The USA and Canada reflect strong industrial demand from construction and energy sectors, while the UAE and Australia contribute due to large-scale infrastructure projects. The UK’s steady imports point to stable demand despite economic shifts. Overall, the sector demonstrates resilience, with balanced dependence across regions and continued opportunities in diversified markets, though pricing competitiveness and trade policies remain key factors shaping export growth.

²⁸ Hs Code- 730630 (Other, Welded, Of Circular Cross-Section, Of Iron Or Non-Alloy)

Top 5 destinations (countries)



Source: Directorate General of Foreign Trade (DGFT)

The import market for welded, circular cross-section pipes has witnessed steady growth from FY 2021 to FY 2025. Imports rose from USD 22.07 million in FY 2021 to USD 41.11 million in FY 2024, before stabilizing slightly at USD 41.08 million in FY 2025. Import volumes followed a similar trend, increasing from 13.57 million in FY 2021 to 29.81 million in FY 2025. This consistent upward movement indicates rising domestic demand for welded pipes, particularly for infrastructure and industrial applications, where foreign suppliers cater to specialized or competitively priced products. The sharp jump in import volumes after FY 2023 reflects both cost advantages from foreign markets and supply-demand gaps in local production.

In FY 2025, Korea dominated imports with a significant 41.65% share (USD 17.11 million), followed by China at 23.42% (USD 9.62 million). Nepal (7.86%), Thailand (6.57%), and Germany (4.65%) accounted for smaller but notable shares. “Others” contributed 15.85% (USD 6.51 million), indicating a moderate level of market diversification. The strong presence of Korea and China underscores their role as cost-competitive suppliers with advanced manufacturing capabilities. Imports from Nepal and Thailand suggest growing regional trade ties, while Germany’s share points to demand for high-quality, specialized products. Overall, the rising import dependency highlights the need for domestic producers to enhance capacity and technology to reduce reliance on foreign markets, while balancing quality and cost competitiveness.

Analysis of key factors that are shaping the demand in the industry

• Urbanization & Real Estate Growth:

Rapid urbanization is structurally expanding the demand for water supply, plumbing, fire-safety, and HVAC networks in buildings core use-cases for IS-grade MS tubes. India is projected to add around 416 million urban residents by 2050, creating long-term requirements for city infrastructure pipelines. At the same time, housing programs such as the PMAY-Urban have sanctioned over 118.6 lakh houses with a total investment exceeding

INR 8.07 lakh crore, underlining strong demand for piping systems in building services such as rising mains, fire loops, and shaft risers.

- **Industrial & Engineering Sector Expansion:**

The expansion of industrial and engineering activity continues to be a strong driver for MS pipes, as they are widely used in process piping, compressed-air lines, utility conduits, and structural supports. India's manufacturing sector is showing steady growth, with the Index of Industrial Production (IIP) for July 2025 recorded at 156.9, reflecting a 5.4% rise in manufacturing activity. This growth indicates robust capacity utilization and capital expenditure, both of which generate significant demand for MS pipes.

- **Substitution Resistance in Specific Applications:**

Despite competition from plastic alternatives, MS pipes maintain strong demand in sectors where strength, weldability, temperature/pressure tolerance, and fire resistance are essential. Indian standards continue to specify MS pipes for critical applications BIS IS 1239 covers welded/seamless steel tubes for water, gas, air, and steam (NB 6–150 mm), while BIS IS 3589 governs steel pipes for water and sewage (OD 168.3–2540 mm). These standards sustain MS usage in water distribution, municipal utilities, and industrial systems .

- **Stringent Environmental Regulations:**

Environmental compliance has led to significant retrofitting across sectors, particularly in power and process industries. Norms such as the Ministry of Environment's 2015 emission notification have driven investment in flue-gas desulphurization, DeNOx systems, and associated ducting and piping applications where MS pipes are essential. Compliance requirements, monitored by the CPCB and CEA, continue to create recurring demand for MS pipes in retrofits and expansions.

- **Oil & Gas (Transmission and City Gas Distribution):**

MS, ERW, and SAW pipes form the backbone of India's oil and gas pipeline network, as well as city gas distribution (CGD) systems. According to the PNGRB, India has an authorized natural gas pipeline network of about 34,233 km, with 25,429 km operational and over 10,459 km under construction as of March 2025. Parallely, CGD expansions are adding PNG connections and CNG stations across multiple Geographical Areas, ensuring sustained demand for MS line pipes, headers, and risers.

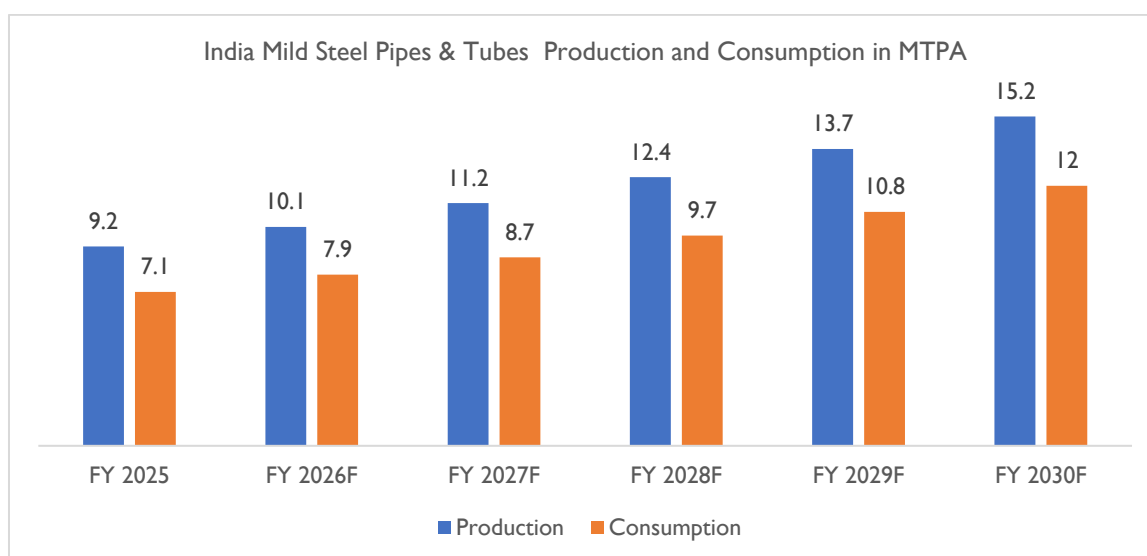
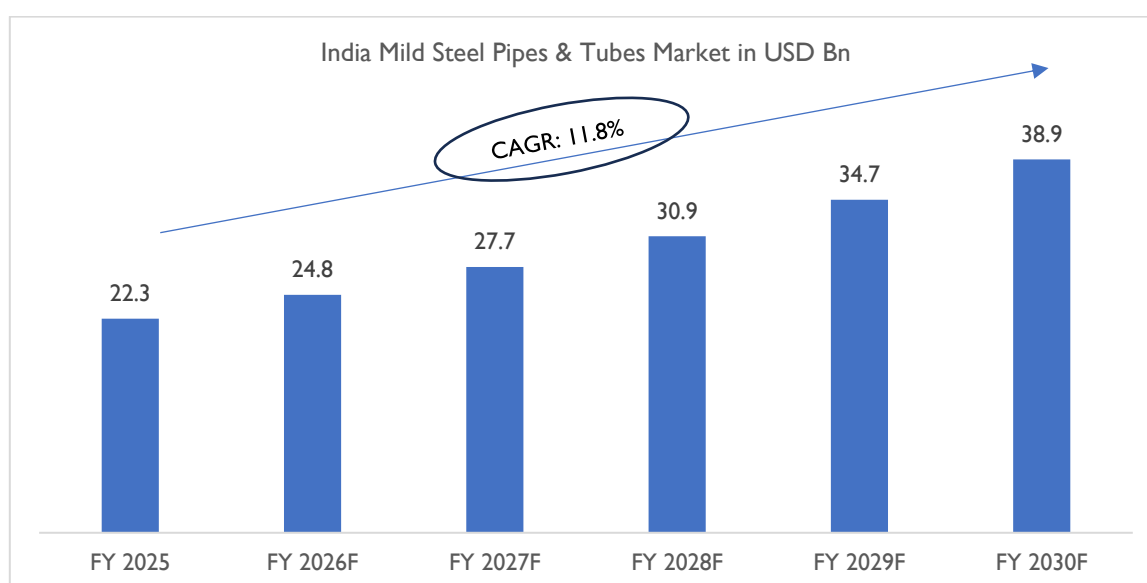
- **Automotive & Engineering Applications:**

MS pipes are extensively used in the automotive ecosystem for plant utilities, jigs, fixtures, and ancillary manufacturing. India's strong automotive production scale supports continuous demand. In FY 2023-24, total vehicle production reached approximately 2.84 crore units, including 2.38 crore two-wheelers and over 50 lakh passenger vehicles. This scale of activity ensures sustained demand for MS pipes across OEMs, suppliers, and shop-floor networks.

Growth forecast: Expected growth in Annual Production & Consumption of MS Pipes & Tubes in India

India's mild steel pipes and tubes market is projected to grow from USD 22.3 billion in FY 2025 to USD 38.9 billion by FY 2030, registering a strong CAGR of 11.8%. This growth is fuelled by rising investments in infrastructure, urban development, housing, water distribution networks, and the rapid expansion of end-use sectors like oil & gas, automotive, and renewables.

At the same time, domestic production is set to increase from 9.2 million tonnes to 15.2 million tonnes (CAGR of 11.1%), while consumption is expected to grow from 7.1 million tonnes to 12 million tonnes (CAGR of 11.8%). The narrowing gap between production and consumption reflects improving domestic capacity, enhanced self-sufficiency, and strong internal demand. Government initiatives such as "Make in India" and the National Infrastructure Pipeline (NIP) are playing a pivotal role in sustaining this growth trajectory.



Source: Primary Research, D&B analysis, F= Forecasted

India's mild steel pipes and tubes market is poised for one of the fastest growth trajectories globally, both in terms of value and volume. The market's growth significantly exceeds the global average, reflecting strong domestic demand across core sectors, especially in water pipeline infrastructure, metro rail, roadways, smart cities, and industrial corridors. This surge is also supported by public and private sector capex in sectors like construction equipment, oil and gas pipeline distribution, and rural infrastructure development.

The parallel rise in both production and consumption, with a slight edge in consumption growth, suggests increasing reliance on domestic capacity to meet growing demand while keeping import dependence in check. This will likely drive capacity expansions and modernization efforts across Indian manufacturers, particularly in the ERW (electric resistance welded) and seamless segments. Additionally, export opportunities may emerge as India strengthens its position as a competitive steel pipe exporter to markets in Asia, the Middle East, and Africa.

India's policy ecosystem focused on import substitution, infrastructure development, and clean energy will continue to create strong tailwinds for the sector. However, this growth also demands significant investment in quality, compliance with international standards, and supply chain efficiency to ensure global competitiveness in both domestic and export markets.

Regulatory Landscape - MS Pipes

IS 1239 (Part 1): 2004 – Steel Tubes	This standard specifies requirements for welded and seamless tubes used in water, non-hazardous gas, air, and steam applications. Covering bore sizes from 6 mm to 150 mm, it classifies pipes into Light, Medium, and Heavy categories with defined tolerances $\pm 8\%$ for Light Duty and $\pm 10\%$ for Medium and Heavy ensuring their quality and suitability for industrial use.
IS 1239 (Part 2): 2011 – Steel Pipe Fittings	This standard specifies the requirements for butt-welded and seamless steel pipe fittings, including plain-ended, screwed, and socketed types. These fittings are designed for use with MS pipes in applications like water, non-hazardous gas, air, and steam. The standard ensures that fittings meet the necessary mechanical properties, dimensions, and quality requirements for safe and reliable performance across different industrial uses.
IS 3601: 2006 – Steel Tubes for Mechanical and General Engineering Purposes	This standard defines the requirements for steel tubes used in mechanical and general engineering applications. It provides specifications on dimensions, tolerances, and mechanical properties to ensure that MS pipes meet the strength, durability, and performance needs for structural and engineering uses. The standard helps maintain consistency and reliability in industrial applications.
IS 1161: 2014 – Steel Tubes for Structural Purposes	This standard lays down the requirements for steel tubes used in structural applications. It specifies the necessary mechanical properties, dimensions, and tolerances to ensure that MS pipes provide strength, stability, and durability in construction frameworks. The standard ensures that the pipes are fit for load-bearing and other structural requirements.

Manufacturing and Quality Control: MS pipes are produced using Submerged Arc Welding (SAW) or seamless manufacturing processes. The production must adhere to strict quality control measures, including

- **Dimensional Accuracy:** Ensuring pipes meet specified sizes and tolerances.
- **Mechanical Properties:** Achieving required tensile strength, yield strength, and elongation.
- **Surface Finish:** Providing appropriate coatings, such as black finish or galvanization, to prevent corrosion.
- **Testing:** Conducting tests for pressure, impact, and other mechanical properties to ensure reliability.

Manufacturers must maintain records of all testing and quality control processes to demonstrate compliance with BIS standards. **Compliance and Enforcement:** Compliance with these standards is mandatory for manufacturers and suppliers of MS pipes in India. Failure to adhere to the prescribed standards can result in penalties, suspension of BIS certification, and legal actions under the Bureau of Indian Standards Act, 2016. Regular audits and inspections by BIS ensure ongoing compliance and quality assurance in the industry.

Broader Impact on the Industry

The regulatory framework for MS pipes ensures that the industry operates under a high level of standardization, quality control, and accountability. By enforcing compliance with **BIS standards** such as IS 1239, IS 3601, and IS 1161, the government safeguards product reliability across water supply, structural, mechanical, and general engineering applications. This consistency benefits end-users and project developers by reducing the risk of failures, improving safety, and ensuring long-term durability of infrastructure.

For manufacturers, strict adherence to testing, inspection, and documentation requirements increases production costs and necessitates continuous investment in quality control systems. Smaller or unorganized players often find it difficult to compete, which drives **industry consolidation** and favors established firms with advanced facilities. At the same time, mandatory certification strengthens market credibility, opening doors for **export opportunities** as Indian MS pipes meet global compliance benchmarks.

From a strategic perspective, these regulations also promote the adoption of **advanced manufacturing practices** such as galvanization and precision welding, while ensuring that the sector aligns with national goals of safety, sustainability, and reliability in infrastructure development. Over time, the regulatory ecosystem not only raises quality standards but also pushes the industry toward modernization, innovation, and global competitiveness.

Analysis of Key Regulatory Policies and Programs Impacting the Industry:

- **Jal Jeevan Mission (JJM):** Launched by the Government of India in 2019, the Jal Jeevan Mission aims to provide safe and adequate drinking water through individual household tap connections to every rural household by 2024. The mission has led to a surge in demand for MS pipes used in water distribution networks across villages. Under this scheme, infrastructure for water supply has expanded significantly, especially in rural areas where pipelines are essential. As of September 2025, Gujarat has successfully provided piped water connections to 91 lakh households through its 'Nal Se Jal' initiative, a part of the JJM.

Impact: The mission has become a major growth driver for MS pipe manufacturers by creating sustained demand in rural water distribution projects. It ensures long-term market visibility and opens opportunities for both large and regional suppliers.

- **PLI Scheme or Specialty Steel:** PLI Scheme for Specialty Steel: In 2025, the Ministry of Steel launched the Production Linked Incentive (PLI) Scheme I.I with an outlay of ₹6,322 crore, aimed at enhancing domestic specialty steel production, improving energy efficiency, and reducing imports. The scheme covers five broad product categories, including Coated/Plated Steel, High Strength/Wear Resistant Steel, Specialty Rails, Alloy Steel Products, and Electrical Steel, with 25 sub-categories. It incentivizes both integrated steel producers and MSMEs, supporting the manufacture of high-quality steel essential for MS pipes. The initiative is expected to attract substantial investment and generate employment opportunities within the steel and pipe manufacturing sectors.

Impact: By incentivizing domestic specialty steel production, the scheme secures critical raw materials for MS pipe manufacturers at competitive costs. It also enhances quality standards, making Indian pipes more competitive in global markets.

- **Make in India Initiative:** Launched on September 25, 2014, by Prime Minister Narendra Modi, the Make in India initiative aims to transform India into a global manufacturing hub by facilitating investment, fostering innovation, building world-class infrastructure, and enhancing the ease of doing business. This initiative focuses on 27 sectors, including MS pipes, to bolster domestic manufacturing capabilities. Under this initiative, the government has implemented several reforms to improve the business environment, such as reducing compliance burdens and decriminalizing outdated provisions. These efforts have led to a significant improvement in India's ranking in the World Bank's Ease of Doing Business index, rising from 142nd in 2014 to 63rd in 2019.

Impact: This initiative strengthens the domestic manufacturing ecosystem, attracting investments and easing compliance for MS pipe producers. Improved ease of doing business allows companies to scale faster and tap export opportunities.

- **Public-Private Partnerships (PPP) in Infrastructure:** The Government of India promotes Public-Private Partnerships (PPPs) to expand urban infrastructure by leveraging private investments and expertise. These partnerships are used in sectors like construction, energy, and water supply, where large-scale projects require materials such as MS pipes. For example, the Ministry of Housing and Urban Affairs encourages PPPs in 24x7 water supply schemes for cities with over a million residents. The Karnataka Urban Water Sector Improvement Project, supported by the World Bank, demonstrates the effectiveness of PPPs in improving urban services. By fostering such partnerships, the government aims to meet the increasing infrastructure demands, thereby facilitating the widespread adoption of MS pipes in various urban development projects.

Impact: PPP-driven projects in water supply and urban infrastructure significantly boost demand for MS pipes in large volumes. They also foster innovation and efficiency, giving organized players a stronger foothold in urban development markets.

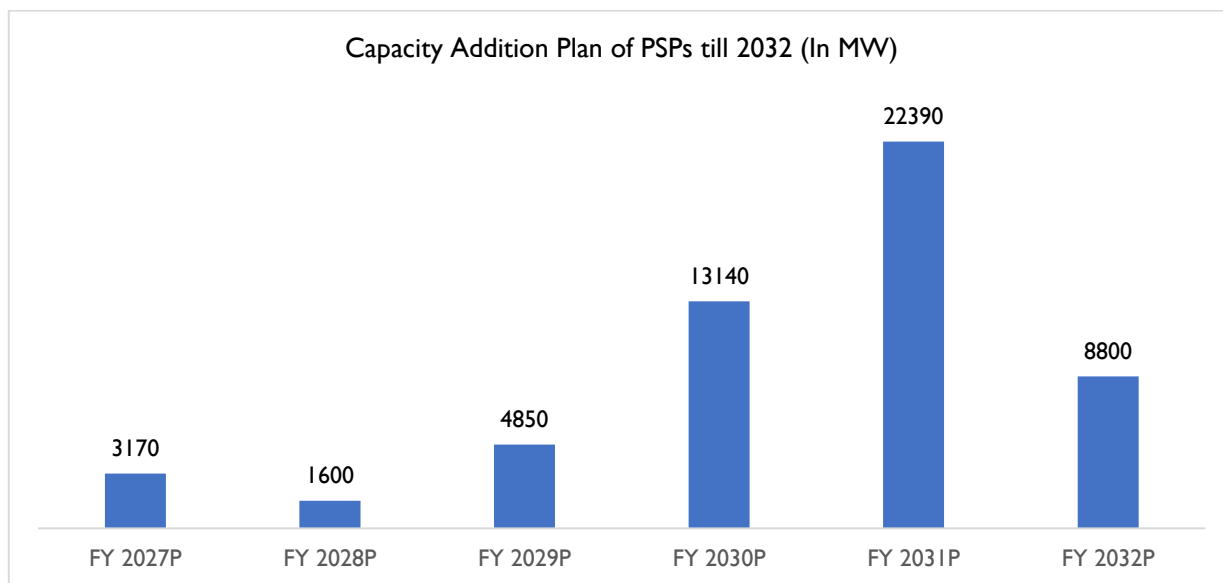
Policy and Regulatory Framework Governing Pumped Storage Projects in India

Pumped Storage Projects ("PSPs") have emerged as a key component of India's long-duration energy storage strategy, supporting renewable energy integration, grid balancing, peak load management and overall power system reliability. Recognising the strategic importance of PSPs, the Government of India has introduced a series of policy, regulatory and institutional initiatives to accelerate project development while establishing a structured technical and implementation framework. The Ministry of Power has issued the **Guidelines to Promote Development of Pumped Storage Projects**, alongside measures such as tariff-based competitive bidding guidelines for procurement of storage capacity, facilitation of enabling infrastructure, and initiatives to streamline project implementation. Complementing these policy initiatives, the **Central Electricity Authority ("CEA")** has established a comprehensive technical framework governing the planning, appraisal and implementation of PSPs, including project identification, survey and investigation, preparation and examination of Detailed Project Reports ("DPRs"), techno-economic appraisal, concurrence, project monitoring and capacity planning.²⁹

The scale of the opportunity reflects the Government's long-term commitment to PSP development. According to the CEA's **"Potential of Pumped Storage Projects in the Country" (July 2026)**, India has an **identified pumped storage potential of approximately 267 GW**, comprising **approximately 58 GW of on-stream potential** and **approximately 209 GW of off-stream potential** across multiple states. As of **July 2026**, the CEA reports **10 operational Pumped Storage Projects**, while **11 projects aggregating approximately 15,870 MW** are under construction. Further, **six projects aggregating approximately 8,140 MW** have been accorded concurrence by the CEA and are awaiting

²⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558&lang=1®=3&https://cea.nic.in/pumped-storage-plants/?lang=en>

commencement of construction. The **CEA Capacity Addition Plan** envisages substantial capacity additions over the coming decade, reflecting the Government's objective of expanding long-duration energy storage infrastructure to support India's energy transition.³⁰



Source: Central Electricity Authority, Govt. of India³¹

Planned capacity additions of Pumped Storage Projects (PSPs) are expected to accelerate significantly towards FY2032, reflecting India's increasing focus on grid flexibility and energy storage. Capacity additions are projected to rise sharply from FY2030, reaching a peak of 22,390 MW in FY2031P before moderating in FY2032P. This expansion is expected to strengthen renewable energy integration, improve grid reliability, and support the country's long-term clean energy transition.

Alongside expansion of the project pipeline, the Government continues to strengthen the institutional and technical framework governing PSP development. The CEA periodically updates technical guidelines relating to DPR preparation, geological and hydrological investigations, engineering design, techno-economic appraisal, documentation requirements and project monitoring to incorporate evolving engineering practices and implementation experience. The Authority has also introduced digital project appraisal mechanisms and issued an **Expression of Interest ("EOI")** to Central Design Organisations ("CDOs") of States to augment technical appraisal capacity and facilitate timely examination of PSP proposals. Collectively, these initiatives demonstrate the Government's focus on developing a structured, transparent and technically robust framework for the planning and execution of PSPs.³² Accordingly, the PSP framework continues to evolve in response to increasing project volumes, technological advancements and the Government's long-term

³⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558&lang=1®=3&https://cea.nic.in/pumped-storage-plants/?lang=en>

³¹ https://cea.nic.in/wp-content/uploads/pumpedstorage/2026/07/PSP_Capacity_addition.pdf

³² <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558&lang=1®=3&https://cea.nic.in/pumped-storage-plants/?lang=en>

renewable energy objectives. As technical standards, engineering specifications, documentation requirements and implementation mechanisms continue to develop, participants across the PSP ecosystem are expected to align with evolving Government requirements throughout the project lifecycle.³³

Execution Framework for Pumped Storage Projects

The implementation of Pumped Storage Projects ("PSPs") in India is governed through a structured framework comprising policy formulation by the Ministry of Power and technical oversight by the Central Electricity Authority ("CEA"). While the Ministry of Power establishes the policy measures intended to promote investment and accelerate project development, the CEA is responsible for prescribing the technical framework governing project planning, appraisal and implementation. Together, these measures are intended to promote standardisation, technical reliability and timely execution of PSPs. The development of a PSP generally follows a sequential execution framework beginning with identification of a suitable project site, preliminary investigations, topographical, geological and hydrological studies, preparation of the Detailed Project Report ("DPR"), techno-economic appraisal by the CEA, statutory and environmental clearances, financial closure, engineering, procurement, construction and commissioning. Progression to each subsequent stage is dependent upon satisfactory completion of the preceding stage and compliance with the applicable technical and regulatory requirements prescribed by the relevant authorities.

To support uniform project development, the CEA has issued detailed technical guidelines governing the preparation of DPRs, engineering investigations, civil works, hydro-mechanical systems, electro-mechanical equipment, geological assessments, hydrological analysis, cost estimates, project appraisal and design review. These guidelines establish the technical documentation and engineering information expected to be submitted during project appraisal and provide a standardised framework for evaluation of PSP proposals. In addition to technical standards, the Government has also introduced measures relating to procurement and project implementation. The Ministry of Power has notified guidelines for **Tariff Based Competitive Bidding ("TBCB")** for procurement of storage capacity from PSPs, with the objective of promoting transparent and competitive procurement mechanisms. The Government has also introduced measures relating to enabling infrastructure, facilitation of statutory approvals and digitalisation of project appraisal processes to improve implementation efficiency and accelerate project execution. Penstock pipes constitute one of the critical hydro-mechanical components of Pumped Storage Projects, serving as high-pressure conduits that convey water between the reservoirs and the turbine-generator units during pumping and electricity generation operations. Consequently, the design, engineering, fabrication, protective coating, supply and installation of penstock pipes form an integral part of PSP execution and are undertaken in accordance with the project-

³³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558&lang=1®=3&https://cea.nic.in/pumped-storage-plants/?lang=en>

specific technical specifications and engineering requirements prescribed during project design and implementation.

Accordingly, project developers, EPC contractors, engineering consultants and suppliers participating in PSPs are required to comply with the applicable technical specifications, engineering standards, documentation requirements and regulatory expectations prescribed under the prevailing Government framework. Since the technical and implementation framework continues to evolve, participants may be required to periodically update engineering methodologies, project documentation, quality assurance systems and execution practices to remain aligned with revised Government guidelines and project-specific technical requirements.

Implications of the Evolving PSP Framework on Industry Participants

The continuing evolution of the PSP policy and implementation framework has implications for participants across the project value chain, including project developers, engineering, procurement and construction ("EPC") contractors, manufacturers and suppliers of hydro-mechanical equipment and fabricated steel products. As the Government strengthens technical appraisal procedures, engineering standards and project implementation mechanisms, participants may be required to continuously align their engineering methodologies, manufacturing capabilities, quality assurance systems, project documentation and execution practices with evolving Government guidelines and project-specific technical requirements.

The development of a PSP generally progresses through multiple sequential stages, including site identification, survey and investigation, preparation of DPRs, techno-economic appraisal by the CEA, statutory and environmental clearances, financial closure, engineering, procurement, construction and commissioning. Progression to each subsequent stage depends upon the satisfactory completion of the preceding stage. Consequently, revisions to technical guidelines, engineering standards, appraisal procedures, documentation requirements or implementation mechanisms may require project developers and associated contractors to undertake additional technical studies, modify engineering designs, revise project documentation or comply with enhanced quality and technical requirements before projects proceed to execution.

For manufacturers and suppliers of **MS Pipes, Penstocks, MS Liners and other fabricated steel products** used in hydroelectric and pumped storage infrastructure, demand is generally linked to the engineering and construction phases of PSPs. Consequently, changes in project specifications, technical requirements, procurement approaches, implementation schedules or project development timelines may influence the timing and scale of procurement associated with individual projects. Participants may also be required to strengthen technical expertise, engineering capabilities, manufacturing processes and quality systems to meet evolving project requirements and customer expectations. Accordingly, while the Government's initiatives are intended to accelerate PSP development and create long-term opportunities within the sector, the evolving policy, technical and implementation framework may also require participants

to continually adapt their systems, capabilities and project execution practices. This provides the context for the related risk factor, which discusses the potential impact of changes in Government policies, technical standards, project implementation mechanisms and procurement practices on companies participating in the PSP value chain.

Regulatory Framework Governing Renewable Energy Banking, Wheeling and Open Access in Maharashtra³⁴

Renewable energy projects operating under captive and open access arrangements in Maharashtra are governed by a regulatory framework administered by the Maharashtra Electricity Regulatory Commission ("MERC"), the Government of Maharashtra, the Ministry of Power and other competent authorities. **The implementation of these regulations is undertaken by the Distribution Company ("DISCOM") and the State Load Despatch Centre ("SLDC") in accordance with the applicable MERC regulations and grid operation procedures.** The framework regulates various aspects of renewable energy procurement and consumption, including Green Energy Open Access, energy banking, wheeling and transmission charges, Cross Subsidy Surcharge ("CSS"), Additional Surcharge, **renewable energy curtailment**, Time-of-Day ("ToD") settlement, scheduling, deviation settlement and other energy accounting mechanisms. These regulations continue to evolve in response to increasing renewable energy penetration, grid balancing requirements and changes in the operational characteristics of the electricity system.

According to the Ministry of New and Renewable Energy ("MNRE"), India's cumulative installed renewable energy capacity (excluding large hydro) reached approximately **236.52 GW** as of June 30, 2026, reflecting the continued expansion of renewable energy generation across the country. In line with this transition, Maharashtra has witnessed several regulatory and policy developments relating to renewable energy banking, wheeling and open access. The Government of Maharashtra issued a revised notification on Green Energy Open Access in May 2026, introducing changes to the implementation framework applicable to renewable energy projects. Further, MERC has revised the Time-of-Day ("ToD") energy accounting and settlement framework by linking the adjustment and utilisation of banked renewable energy to the applicable ToD slots. The revised framework restricts the adjustment of banked energy in accordance with the prescribed ToD categories and settlement methodology. In addition, the DISCOM and SLDC implement curtailment instructions for renewable energy projects under specified grid security, transmission congestion and system

³⁴ <https://cdnbbsr.s3waas.gov.in/s3c0af6df3a5a0ba53004ab39704a9a7f6/uploads/2026/05/202605131257891591.pdf>
<https://merc.gov.in/>
<https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf>
<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1923863®=48&lang=2>
[https://www.acma.in/uploads/ciculer-attachement/Electricity%20\(Promoting%20Renewable%20Energy%20through%20Green%20Energy%20Open%20Access\)%20Rules,2022.pdf](https://www.acma.in/uploads/ciculer-attachement/Electricity%20(Promoting%20Renewable%20Energy%20through%20Green%20Energy%20Open%20Access)%20Rules,2022.pdf)

reliability conditions in accordance with the applicable MERC regulations and grid operating procedures. Regulatory proceedings and judicial interventions relating to energy banking and settlement provisions further demonstrate that the regulatory framework continues to evolve, particularly with respect to the treatment of surplus energy, settlement methodologies and operational flexibility under captive and open access arrangements.

Key regulatory developments influencing renewable energy projects operating under captive and open access arrangements in Maharashtra include:

- **Energy Banking:**³⁵

Periodic revisions to banking provisions governing the adjustment, carry forward and settlement of surplus renewable energy. Under the prevailing MERC framework, banked renewable energy is adjusted and settled in accordance with the applicable energy accounting mechanism and prescribed banking provisions. Recent regulatory revisions have introduced Time-of-Day ("ToD") linked banking, whereby the adjustment and utilisation of banked energy are subject to the applicable ToD categories and prescribed settlement methodology, influencing the commercial benefits available under captive and open access arrangements.

- **Wheeling and Transmission Charges:** ³⁶

Wheeling and transmission charges are periodically determined by MERC through tariff orders and are applicable to renewable energy transactions undertaken under open access arrangements. The applicable charges vary depending on factors such as the voltage level, category of consumer, point of connectivity and applicable regulatory provisions. MERC periodically reviews these charges through tariff proceedings to reflect changes in network costs and regulatory requirements. Any revision in wheeling or transmission charges may influence the delivered cost of renewable energy and the commercial viability of captive and open access projects.

- **Cross Subsidy Surcharge ("CSS") and Additional Surcharge:** ³⁷

MERC periodically notifies the applicable CSS and Additional Surcharge through tariff orders issued for different categories of consumers. The applicable surcharge varies depending on the consumer category, voltage level, source of power procurement and the prevailing regulatory framework. These surcharges are intended to compensate the distribution licensee for cross-subsidy obligations and stranded fixed costs arising

³⁵ https://www.mahadiscom.in/consumer/wp-content/uploads/2025/06/Order_Case-No.75-of-2025.pdf?

³⁶ <https://merc.gov.in/wp-content/uploads/2025/03/Final-Common-Order-in-Case-Nos.-79-and-80-of-2024-1.pdf?>

³⁷ https://www.mahadiscom.in/consumer/wp-content/uploads/2025/06/Order_Case-No.75-of-2025.pdf?

from open access transactions. Periodic revisions to CSS and Additional Surcharge may affect the overall economics of renewable energy procurement under captive and open access arrangements.

- **Time-of-Day ("ToD") Settlement:**³⁸

MERC has introduced and periodically revised ToD scheduling, energy accounting and settlement provisions to promote efficient utilisation of renewable energy and improve grid balancing. Under the prevailing framework, renewable energy generated, banked and consumed is accounted for based on the applicable ToD categories, with differentiated settlement mechanisms for specified time blocks. Recent revisions have modified the treatment of ToD banking and settlement to better align renewable energy consumption with grid requirements and system demand patterns. These provisions may influence the financial benefits derived from renewable energy projects operating under captive and open access arrangements.

- **Renewable Energy Curtailment:**³⁹

Renewable energy generation may be curtailed by the Distribution Company ("DISCOM") or the State Load Despatch Centre ("SLDC") under specified grid security, transmission congestion or system reliability conditions in accordance with the applicable MERC regulations and grid operation procedures. Curtailment may be undertaken to maintain grid stability, system security and reliable operation of the electricity network. The operational impact of curtailment depends on the duration, frequency and prevailing regulatory provisions governing compensation or settlement, where applicable. Consequently, curtailment remains an important regulatory and operational consideration for renewable energy projects.

- **Energy Storage Integration:**

MERC and the Government of Maharashtra continue to encourage the integration of energy storage systems to improve renewable energy integration and enhance grid reliability. Energy storage facilitates load shifting, peak demand management, renewable energy balancing and improved utilisation of intermittent renewable resources. Regulatory provisions relating to storage continue to evolve with the increasing deployment of battery energy storage systems and other storage technologies. Greater integration of energy storage is expected to support higher renewable energy penetration while improving overall grid flexibility.

- **Judicial and Regulatory Proceedings:**⁴⁰

Judicial and regulatory proceedings relating to renewable energy banking, Time-of-Day ("ToD") settlement and open access have been initiated before the Maharashtra Electricity Regulatory Commission ("MERC"), the Appellate Tribunal for Electricity ("APTEL") and the Bombay High Court. Recent proceedings have primarily challenged revisions relating to banking provisions, ToD-linked energy settlement, tariff implementation and open access approvals. Certain matters have been remanded by the Bombay High Court

³⁸ https://www.mahadiscom.in/consumer/wp-content/uploads/2025/06/Order_Case-No.75-of-2025.pdf?

³⁹ https://www.mahadiscom.in/consumer/wp-content/uploads/2025/06/Order_Case-No.75-of-2025.pdf?

⁴⁰ <https://www.mercomindia.com/industry-gets-interim-relief-as-aptel-stays-mercs-new-banking-linked-power-bills?utm>

for fresh consideration by MERC after stakeholder consultation, while APTEL has granted interim relief in specific cases relating to the implementation of revised banking provisions pending final adjudication. Consequently, the regulatory position continues to evolve, and the final outcome of these proceedings may influence the implementation of banking mechanisms, ToD settlement provisions, tariff treatment and the commercial framework applicable to renewable energy projects operating under captive and open access arrangements in Maharashtra.

- **Policy Evolution:** ⁴¹

The regulatory framework governing renewable energy in Maharashtra continues to evolve through amendments to MERC regulations, Green Energy Open Access provisions, tariff orders and Government notifications. These policy revisions are intended to facilitate renewable energy integration, improve grid reliability, promote efficient energy utilisation and align the State's regulatory framework with evolving national renewable energy policies. Project developers, captive consumers and open access users are therefore required to continually monitor regulatory developments to ensure ongoing compliance with the applicable framework.

Material Regulatory Developments in India's Pumped Storage Project (PSP) Framework and Their Implications ⁴²

India's regulatory framework for Pumped Storage Projects (PSPs) has undergone significant changes in recent years as the Government has intensified its efforts to strengthen long-duration energy storage infrastructure and facilitate the integration of renewable energy into the national grid. While earlier policy initiatives largely focused on project identification and development, the recent framework has expanded to cover the entire project lifecycle from project planning and technical appraisal to procurement, environmental clearances, construction monitoring and commercial viability. These changes are intended to accelerate project implementation, improve investment confidence and strengthen engineering and quality standards across the sector.

⁴¹ https://www.mahadiscom.in/consumer/wp-content/uploads/2025/06/Order_Case-No.75-of-2025.pdf?

⁴² <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2149363®=48&lang=2>
<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=48&lang=2>

Material Changes in the Regulatory Framework

Area	Recent Development	Material Change	Implications for Industry Participants	Official Source
Project Development Framework	Ministry of Power issued comprehensive PSP Guidelines	Established a structured framework covering project allocation, private sector participation, utilisation of exhausted mines, enabling infrastructure and facilitation of statutory approvals.	Provides greater policy certainty, encourages private investment and supports faster project initiation.	Ministry of Power – PSP Guidelines
Technical Appraisal ⁴³	CEA revised the Guidelines for Formulation and Concurrence of DPRs	DPR concurrence timeline reduced from 90 days to 50 days (approximately 44% reduction), along with rationalisation of appraisal procedures and removal of inter-state aspect clearance requirements for PSPs.	Shorter appraisal timelines can improve project readiness; however, developers are required to submit technically comprehensive DPRs supported by detailed engineering investigations.	CEA; PIB
Digital Project Monitoring ⁴⁴	Introduction of the Jal Vidyut DPR Portal	Digital platform introduced for monitoring survey, investigation and DPR appraisal activities.	Improves transparency, enables real-time monitoring and increases accountability during project development.	PIB
Environmental Approvals ⁴⁵	MoEF&CC introduced revised appraisal measures for eligible PSPs	Eligible off-stream PSPs benefit from simplified environmental appraisal procedures, project-specific Terms of Reference and expanded investigation provisions in forest areas.	Facilitates faster project preparation while maintaining project-specific environmental compliance requirements.	PIB
Commercial Framework ⁴⁶	Tariff-Based Competitive Bidding (TBCB) Guidelines notified for energy storage procurement	Introduced a transparent procurement framework for storage capacity and stored energy from PSPs.	Improves revenue visibility and enhances the bankability of PSP investments.	Ministry of Power
Financial Incentives ⁴⁷	Transmission incentives and regulatory simplification	Eligible PSPs awarded by 30 June 2028 are entitled to a 100% waiver of Inter-State Transmission System (ISTS) charges for 25 years . In addition, the capital expenditure threshold requiring CEA concurrence has been increased to ₹3,000 crore , while off-stream closed-loop PSPs are exempt from concurrence irrespective of project cost.	Improves project economics, reduces regulatory burden for eligible projects and enhances investment attractiveness.	PIB

⁴³ <https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2286558&lang=1®=6>

⁴⁴ <https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2047047®=48&lang=2>

⁴⁵ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=3&lang=1>

⁴⁶ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=3&lang=1>

⁴⁷ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=3&lang=1>

Technical and Quality Enhancements

One of the most significant changes introduced under the revised framework is the increased emphasis on **engineering quality during the project preparation stage**. The latest **CEA Guidelines for Formulation of Detailed Project Reports (Version 3)** require more comprehensive geological investigations, hydrological assessments, optimisation of water conductor systems, civil and electro-mechanical design validation, and integrated engineering documentation before projects are submitted for technical appraisal. Compared with earlier practices, greater emphasis is now placed on completing critical engineering investigations upfront, thereby reducing the likelihood of design revisions and execution challenges during construction.

For EPC contractors, engineering consultants and equipment suppliers, this translates into greater involvement during the planning and design stages, stronger engineering capabilities and higher expectations regarding technical documentation and design validation.

The regulatory framework also reflects a stronger focus on quality assurance and project governance. In parallel with the revised DPR requirements, the CEA continues to strengthen quality management practices through guidance on Quality Assurance Plans (QAPs), factory inspection, equipment testing and standardised engineering documentation across power sector projects. While these measures are not exclusive to PSPs, they reinforce the importance of quality control, material traceability, testing and compliance for hydro-mechanical and electro-mechanical equipment deployed in PSP development.

Compliance Implications ⁴⁸

The recent policy framework expands compliance requirements beyond obtaining statutory approvals. Developers are now expected to demonstrate technical preparedness through detailed DPRs, comply with revised environmental appraisal procedures, satisfy CEA's technical appraisal requirements and maintain comprehensive engineering documentation throughout the project lifecycle. In addition, projects seeking benefits under government support measures such as ISTS charge waivers or tariff-based procurement must comply with the eligibility conditions prescribed under the respective policy framework.

These developments increase the importance of early-stage engineering, regulatory planning and documentation, while also improving transparency and consistency in project appraisal.

⁴⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=48&lang=2>

<https://www.powermin.gov.in/en/content/guidelines-promote-development-pumped-storage-projects>

Risk Assessment ⁴⁹

Although the revised framework is expected to facilitate faster project development, successful implementation remains dependent on timely completion of geological investigations, environmental and forest clearances, preparation of technically compliant DPRs and successful regulatory appraisal. The reduction in appraisal timelines increases the importance of submitting technically complete and well-supported project documentation at the initial stage, as deficiencies may lead to additional observations or resubmissions.

From an execution perspective, the stronger emphasis on engineering quality, design validation and technical compliance is expected to reduce construction-stage uncertainties and improve overall project reliability. However, it may also increase upfront engineering effort, project preparation costs and documentation requirements for developers, EPC contractors and equipment suppliers.

Implications for EPC Contractors, Engineering Consultants and Equipment Suppliers ⁵⁰

The evolving PSP framework is expected to increase demand for specialised engineering expertise and technically compliant equipment. As project appraisal becomes more structured and engineering standards continue to strengthen, EPC contractors and equipment suppliers are likely to experience higher expectations regarding design validation, quality assurance, factory testing, engineering documentation and project traceability.

While these requirements may increase upfront engineering and compliance costs, they are also expected to improve execution quality, reduce the likelihood of construction-stage modifications and support timely project commissioning. With India's PSP pipeline expanding steadily, the strengthened regulatory framework is expected to create long-term opportunities for companies involved in engineering consultancy, hydro-mechanical equipment, fabricated steel structures, penstocks, pressure shafts and associated balance-of-plant infrastructure.

⁴⁹ <https://cea.nic.in/pumpedstorage/%ef%84%81-guidelines-for-formulation-of-detailed-project-reports-for-pumped-storage-schemes-version-3/?lang=en>

<https://www.scribd.com/document/878424723/9-Guidelines-for-Formulation-of-Detailed-Project-Reports-for-Pumped-Storage-Schemes-July-2024-Version-3-0>

⁵⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2286558®=48&lang=2>
<https://cea.nic.in/pumpedstorage/>

Use of Penstock Pipes in Pumped Storage Projects ⁵¹

Penstock pipes are among the most critical hydro-mechanical components of a Pumped Storage Project (PSP), serving as high-pressure conduits that transfer water between the reservoirs and the powerhouse during both pumping and power generation cycles. Given the cyclic operation of PSPs and the high hydraulic pressures involved, penstocks are required to withstand significant internal pressure, hydraulic transients (water hammer), fatigue loading and long-term operational stresses. Consequently, their design, material selection, fabrication quality, welding integrity, corrosion protection and installation play a critical role in ensuring the safety, operational efficiency and long-term reliability of PSPs.

The **Central Electricity Authority (CEA)**, through the **Guidelines for Formulation of Detailed Project Reports for Pumped Storage Schemes (Version 3)**, places significant emphasis on detailed engineering of the water conductor system, including pressure shafts, penstocks, surge arrangements, hydro-mechanical works and electro-mechanical integration. Compared with earlier project development practices, the revised guidelines require more comprehensive engineering investigations, hydraulic optimisation and technical validation during the DPR stage, reinforcing the importance of technically compliant penstock systems and robust fabrication standards.

Demand Outlook for Penstock Pipes ⁵²

The Government's continued focus on expanding pumped storage capacity is expected to create sustained demand for fabricated steel penstocks and other hydro-mechanical equipment. According to the **Ministry of Power**, as of **20 July 2026**, India had **11 pumped storage projects under construction** with an aggregate installed capacity of **15,870 MW**, while **six projects with a combined capacity of 8,140 MW** had completed appraisal by the Central Electricity Authority and were awaiting construction. In parallel, policy initiatives such as streamlined project approvals, tariff-based competitive bidding, transmission charge waivers and enabling infrastructure support are expected to accelerate the implementation of new PSPs.

Looking ahead, the **Central Electricity Authority's National Electricity Plan (Generation)** projects that India will require **26.69 GW (175.18 GWh)** of pumped storage capacity by **2031–32**, compared with **7.45 GW (47.65 GWh)** by **2026–27**. This represents an additional requirement of over **19 GW** of PSP capacity within the planning period, indicating a substantial long-term pipeline of projects that will require

⁵¹ <https://cea.nic.in/pumpedstorage/%EF%84%81-guidelines-for-formulation-of-detailed-project-reports-for-pumped-storage-schemes-version-3/>

⁵² <https://pib.gov.in/PressReleasePage.aspx?PRID=2286558>
<https://pib.gov.in/PressReleasePage.aspx?PRID=2290015>

extensive hydro-mechanical infrastructure, including penstock pipes, pressure shafts, embedded steel liners, valves and associated fabricated steel components.

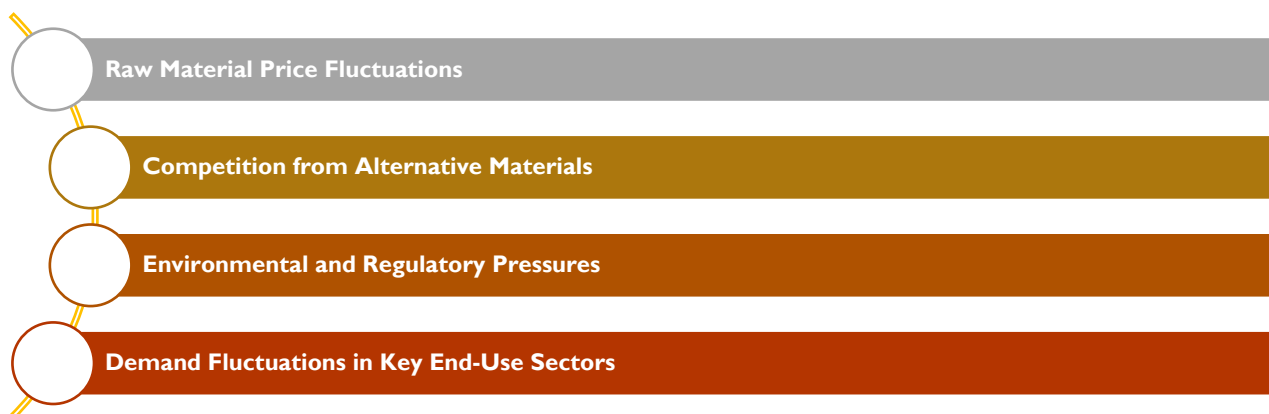
Implications for Penstock Manufacturers ⁵³

The evolving regulatory framework has increased the importance of engineering quality and technical compliance in PSP development. The revised DPR guidelines require more detailed engineering studies and greater technical validation before project appraisal, while the CEA continues to strengthen engineering review and quality assurance practices for hydroelectric infrastructure. As a result, manufacturers of penstock pipes are increasingly expected to demonstrate capabilities in precision fabrication, qualified welding procedures, non-destructive testing (NDT), dimensional control, corrosion protection and compliance with project-specific technical specifications.

The expansion of India's PSP pipeline, coupled with increasingly rigorous engineering and quality requirements, is expected to support sustained demand for manufacturers with established capabilities in producing large-diameter, high-pressure fabricated steel penstocks and other hydro-mechanical equipment required for pumped storage projects.

Threats & Challenges – MS Pipes

Key Threats



- **Raw Material Price Fluctuations:** The MS pipes industry is highly dependent on steel as the core raw material, and the price of steel is subject to substantial fluctuations. Factors such as global supply-demand dynamics, changes in crude oil prices (which affect energy and transportation costs), geopolitical tensions, and government-imposed tariffs or anti-dumping duties can lead to sharp cost increases. These price swings directly impact manufacturing expenses, making it difficult for producers to maintain stable pricing

⁵³ <https://cea.nic.in/hydro-engineering-technology-development-division/>

<https://cea.nic.in/pumpedstorage/%EF%84%81-guidelines-for-formulation-of-detailed-project-reports-for-pumped-storage-schemes-version-3/>

and predictable profit margins. Smaller and mid-sized manufacturers, in particular, have limited capacity to absorb cost shocks, which may affect their financial stability and ability to fulfil contracts at competitive rates.

- **Competition from Alternative Materials:** The rise of alternative piping solutions poses a significant threat to the MS pipes segment. Materials such as stainless steel, aluminium, PVC, HDPE, and composite pipes are increasingly preferred for their specific advantages. For example, stainless steel pipes offer superior corrosion resistance, while plastic pipes are lightweight and easier to install. In sectors such as water distribution, chemical processing, and infrastructure development, customers are exploring long-term cost savings and performance benefits offered by these alternatives. As a result, demand for MS pipes in some segments may stagnate or decline, compelling manufacturers to differentiate their offerings or lose market share.
- **Environmental and Regulatory Pressures:** The production and processing of steel involve energy-intensive operations and contribute significantly to carbon emissions and industrial waste. Governments worldwide are tightening environmental regulations to reduce pollution, enhance sustainability, and encourage recycling. Compliance with these rules requires companies to invest in cleaner technologies, waste management systems, and energy-efficient equipment. These upgrades often entail high capital expenditure, which smaller companies may find difficult to bear. Additionally, non-compliance can result in hefty fines, project delays, or loss of licenses, making environmental regulations a critical operational risk for the industry.
- **Demand Fluctuations in Key End-Use Sectors:** MS pipes are widely used in infrastructure projects, construction, manufacturing, oil & gas pipelines, and water distribution. The demand from these sectors is closely tied to macroeconomic factors such as GDP growth, government spending, and private sector investments. Any slowdown in infrastructure development, stalled projects, or disruptions in funding can lead to reduced demand for pipes. For manufacturers, such demand variability complicates capacity planning, inventory management, and workforce allocation.

Key Challenges:



- **High Production and Operational Costs:** Manufacturing MS pipes requires significant investment in facilities, equipment, and technology. In addition to capital expenditures, operational costs such as energy, labour, and maintenance are substantial. Steel processing consumes large amounts of electricity and fuel, and fluctuations in these input costs further add to the financial burden. Small and mid-sized producers often face challenges in controlling these costs while competing with larger players that benefit from economies of scale.
- **Maintaining Product Quality and Consistency:** MS pipes are used in critical applications where strength, durability, and safety are paramount. Ensuring that each batch meets industry standards for tensile strength, corrosion resistance, and structural integrity requires strict process control, advanced testing equipment, and skilled technicians. Variations in raw material quality or inconsistencies in manufacturing can lead to defects, customer dissatisfaction, and project rejections, making quality assurance a constant challenge.
- **Technological Advancement and Modernization:** The industry is under pressure to adopt newer manufacturing technologies that enhance efficiency, reduce waste, and improve product properties. Automation, digital monitoring, and advanced coating techniques are increasingly expected in modern production setups. However, upgrading old plants or setting up new facilities with cutting-edge technology demands significant financial resources and technical expertise, which may not be easily accessible to all players.
- **Supply Chain Disruptions:** The MS pipe industry relies on a seamless supply chain for raw materials, energy, logistics, and skilled labour. Any disruption whether due to transportation bottlenecks, port congestion, strikes, or geopolitical events can cause delays and cost overruns. In particular, remote manufacturing units or those dependent on imported steel face heightened vulnerability during global crises or regulatory changes affecting imports.

Competitive Landscape

The Indian infrastructure-linked sectors of railway concrete sleepers, mild steel (MS) pipes, and wind energy share several structural characteristics. They are all capital-intensive, rely heavily on government-driven demand and policies, and operate under strict technical and regulatory compliance requirements. Procurement across these industries is largely conducted through tendering or long-term contracts, which places competitive emphasis on pricing, execution reliability, and capacity utilization. Entry barriers are naturally high due to the need for specialized approvals, certifications, and significant upfront investment.

In the railway concrete sleeper industry, competition is highly centralized, with Indian Railways acting as the dominant procurer. Vendors must obtain approval from the Research Designs and Standards Organisation (RDSO), which limits participation to a select pool of qualified manufacturers. Contracts are awarded through competitive tendering, and since Pre-Stressed Concrete (PSC) sleepers follow standardized designs, differentiation is minimal. Competitive intensity is therefore shaped by plant location, cost efficiency, and production capacity. The combination of high capital costs, stringent RDSO approval processes, and dependence on a single institutional buyer makes this a consolidated and entry-restricted market.

The MS pipe and wind energy sectors display different but equally competitive dynamics. The MS pipe market is fragmented, comprising both large, organized manufacturers and a broad base of regional unorganized players. Success depends on raw material security, certifications, distribution reach, and the ability to manage steel price volatility. Conversely, the wind energy sector is policy-driven, with capacity awarded primarily through competitive auctions conducted by SECI and state utilities. Players in this sector compete on tariff efficiency, access to advanced turbine technology, and execution capability. Both industries carry significant entry barriers MS pipes through compliance and working capital intensity, and wind energy through capital requirements, policy risks, and long gestation periods ensuring that scale and proven track record remain decisive factors in sustaining competitiveness.

Analysis of key factor shaping competition in the sector

❖ **Railway Concrete Sleeper Industry:**

- **Centralized Procurement by Indian Railways:** Competition is concentrated in a single-buyer environment, where allocation of supply contracts is determined entirely through the tendering system.
- **Limited Vendor Base (RDSO Approval Requirement):** Only manufacturers approved by the Research Designs and Standards Organisation (RDSO) are eligible to bid, significantly reducing the number of competitors.

- **Standardized Product Specifications:** Pre-Stressed Concrete (PSC) sleepers are manufactured to uniform designs, leaving minimal scope for product differentiation. Competitive intensity therefore centers around pricing efficiency, reliability of supply, and timely execution.
- **Geographic Advantage:** Plants located closer to project sites or railway zones enjoy lower freight costs, which improves competitiveness in tendering and enhances order allocation prospects.
- **Dependence on Railway Capex:** Demand directly tracks the pace of railway investments in track renewals, new line construction, and gauge conversion.

❖ **Mild Steel (MS) Pipes**

- **Fragmented Market Structure:** The industry consists of both large organized players and a wide base of regional unorganized manufacturers, creating varied competition across customer segments.
- **Raw Material Linkages:** Access to hot-rolled coil (HRC) at competitive prices, often through backward integration with steel mills, provides cost stability and an advantage for larger players.
- **Certification and Quality Compliance:** End-use industries such as oil & gas, water transmission, and construction mandate compliance with standards (e.g., BIS, API), restricting participation to certified manufacturers.
- **Price Volatility of Steel:** Frequent fluctuations in steel prices affect input costs and margins, intensifying competitive pricing pressures.
- **Distribution and Market Reach:** Large organized players leverage national dealer networks and export channels, while smaller firms primarily compete on cost within regional markets.

❖ **Wind Energy**

- **Policy-Driven Market:** Growth is anchored by initiatives such as the National Wind-Solar Hybrid Policy and capacity auctions conducted by SECI and state utilities.
- **Tariff-Based Bidding:** Competitive auctions have compressed tariffs, making efficiency in project development and execution the most critical differentiator.
- **Technology Dependence:** Access to high-capacity turbines through global OEMs or partnerships gives developers an edge in cost and performance.
- **Scale and Execution Capabilities:** Larger developers and integrated turbine manufacturers hold an advantage in securing projects due to economies of scale, stronger financing access, and established O&M capabilities.
- **Track Record and Credibility:** Past performance in timely project execution, grid integration, and adherence to PPA terms enhances eligibility and competitiveness for future project awards.

❖ **Railway Concrete Sleeper Industry:**

- **High Capital Intensity:** Establishing a sleeper plant requires substantial investment in specialized equipment such as batching plants, pre-stressing systems, and curing infrastructure.
- **Stringent Approval and Compliance Process:** The RDSO approval cycle involves detailed inspections, quality audits, and trial batches, prolonging the time to market for potential entrants.
- **Long Gestation Period:** Even after commissioning, new players may require 24–36 months before obtaining full vendor approval and consistent supply orders.
- **Single-Buyer Concentration Risk:** Heavy dependence on Indian Railways exposes new entrants to risks from budgetary delays or procurement policy changes.

❖ **Mild Steel (MS) Pipes**

- **Moderate Entry Barriers:** While capital intensity is relatively lower, scale and certifications act as natural filters.
- **Working Capital Intensity:** High inventory requirements and extended credit cycles strain smaller manufacturers.
- **Reliance on Institutional Buyers:** Large buyers prefer vendors with proven reliability, creating barriers for new entrants.
- **Gradual Consolidation Trend:** Rising compliance requirements are steadily shifting share toward organized players.

❖ **Wind Energy**

- **High Capital Intensity:** Wind projects require significant upfront investment in land, turbines, and grid infrastructure.
- **Financing Constraints:** Lenders prefer established players with strong balance sheets, limiting access for new entrants.
- **Policy and Regulatory Risks:** Frequent tariff changes, land acquisition hurdles, and transmission delays create uncertainties for prospective entrants.
- **Long Gestation Period:** Development cycles of 18–24 months delay cash flows and add to the financial risk for new players.

Notable players operating in the industry

Peers Profiling: Indian Hume Pipe Company Limited

Overview: The Indian Hume Pipe Co. Ltd. (IHP), established in 1926, is an Indian infrastructure company engaged in manufacturing and installing large-diameter concrete and steel pipes. With a network of over twenty factories and more than 100 ongoing projects across India, IHP has undertaken initiatives in water supply, drainage, sewerage, and power generation. The company has also executed projects in neighbouring countries like Nepal, Sri Lanka, Myanmar, Malaysia, and Iraq. IHP is committed to delivering infrastructure solutions through its manufacturing capabilities and project execution teams.

Products & Service offerings:

- Prestressed Concrete Pipes (PSC)
- Prestressed Concrete Cylinder Pipes (PCCP)
- Bar Wrapped Steel Cylinder Pipes (BWSC)
- Reinforced Cement Concrete (RCC) Pipes
- Steel Pipes
- Penstock Pipes
- Concrete Sleepers
- Sports Rifles

Key Customer Segments Served:

- Central Government Entities
- State Government Entities
- Private Sector Clients

Key Strengths:

- **Established Expertise:** With over nine decades of experience, IHP has a proven track record in executing large-scale engineering, procurement, and construction (EPC) projects, particularly in water supply, irrigation, and sewerage systems.
- **Extensive Manufacturing Network:** The company operates 19 factories across eight states in India, enabling efficient production and timely delivery of concrete pressure pipes.
- **Geographic and Project Diversity:** IHP's operations span 12 Indian states and extend to neighbouring countries, providing a diversified order book and reducing dependency on any single market.

Peers Profiling: GPT Infraprojects Limited

Overview:

GPT Infraprojects Limited, established in 1980, is a Kolkata-based infrastructure company specializing in civil construction and concrete sleeper manufacturing. With over four decades of experience, the company offers turnkey solutions in sectors such as railways, roads, bridges, power, and industrial infrastructure. GPT Infraprojects operates manufacturing facilities in India, South Africa, Namibia, and Ghana, serving a diverse clientele that includes government entities and private developers. The company is recognized for its end-to-end capabilities from design and construction to maintenance reinforcing its position as a trusted infrastructure partner.

Products & Service offerings:

- **Infrastructure Division:** Civil Construction, Road Building, Railway Track Construction
- **Concrete Sleepers Division:** Monoblock sleepers for broad gauge, Line sleepers, PSC sleepers for 1 in 8.5 turnout, PSC sleepers for 1 in 12 turnout, PSC sleepers for 1 in 16 turnout, Bridge deck sleepers, Monoblock sleepers for dual gauge (1,000 mm and 1,676 mm), Monoblock sleepers for cape gauge (1067 mm) for 22 MT & 32 MT axle load, Level crossing and switch expansion joint

Key Customer Segments Served:

- Government Railways Authorities
- Highways & Road Authorities
- Industrial Clients & Plants
- International Railway & Infrastructure Bodies
- Airport and Metro / Light Rail Authorities

Key Strengths:

- **Extensive Experience in Infrastructure & Sleeper Manufacturing:** GPT Infraprojects has over four decades of experience in civil construction and infrastructure work, combined with strong capabilities in manufacturing concrete sleepers.
- **End-to-End Capabilities Across Sectors:** The company handles a broad portfolio: from design and construction to maintenance spanning roads, railway bridges, tracks, steel bridges, metro work, industrial infrastructure, etc. This breadth helps it address many types of projects.
- **International Manufacturing Footprint:** GPT operates concrete sleeper manufacturing not only in India but also in several African countries such as South Africa, Namibia, and Ghana. This gives it global reach and diversified exposure.

Company Overview:

Vishal Nirmiti Limited (VNL), was founded in 1994 and has built its presence across the infrastructure and manufacturing sectors for three decades. The company's activities span a wide portfolio that includes the manufacturing of pre-stressed concrete (PSC) sleepers, pre-cast concrete elements such as railway noise barriers, fabrication of MS pipes, production of LSAW and HSAW pipes with coating for pipeline projects, as well as hydro-mechanical equipment for water resource management. Alongside these, the company extends its expertise into infrastructure services.

Vishal Nirmiti Limited traces its corporate history to 30th June 1994, when the legal entity was incorporated as **Sejal Farms Private Limited**. Over the years, the Company changed its name and business activities, first to **Vinamra Trading Company Private Limited** in **2004** and subsequently to **Vishal Nirmiti Private Limited** in **2005**, reflecting the evolution of its business focus. Pursuant to an order dated **23rd November 2007** passed by the **Hon'ble High Court of Judicature at Bombay approving the Scheme of Amalgamation, Prestress (India) Private Limited, Marathwada Prestress Private Limited and Permanent Prestress Private Limited** were amalgamated with the Company. In accordance with the scheme, the assets, liabilities, existing contracts and business operations of the amalgamating companies were transferred to and vested in the Company. Subsequently, in **September 2025**, the Company was converted into a **public limited company** and renamed **Vishal Nirmiti Limited**.

The amalgamation significantly expanded the Company's infrastructure business. In the railway infrastructure segment, the Company acquired the PSC sleeper manufacturing business of Prestress (India) Private Limited and Marathwada Prestress Private Limited, including the manufacturing facilities located at Mohol, Maharashtra and Bankhedi, Madhya Pradesh, respectively. As part of the amalgamation, the licences, approvals, existing contracts, and associated rights relating to the manufacture and supply of pre-stressed concrete ("PSC") sleepers were transferred to the Company, enabling it to continue executing existing railway contracts and to produce and supply PSC sleepers. In the infrastructure business, the Company continued to expand its execution capabilities and received its first infrastructure sub-contract in the name of Vishal Nirmiti Private Limited on **28th December 2007** for a project undertaken for **the Pimpri Chinchwad Municipal Corporation ("PCMC")**. Building on these capabilities, the Company subsequently expanded its product portfolio to include railway noise barriers, Longitudinal Submerged Arc Welded (LSAW) pipes, Helically Submerged Arc Welded (HSAW) pipes with protective coating systems, hydro-mechanical equipment, fabricated steel products, as well as engineering, fabrication, installation and civil infrastructure services.

The company's registered office is located in Mumbai, while its corporate office is in Pune. These offices support its operational base and facilitate coordination across its various business areas. These facilities are equipped with steel forming, welding, and coating technologies, enabling VNL to align its output with Indian

and international standards. With this infrastructure in place, the company serves the requirements of large-scale railway, pipeline, and civil construction projects while ensuring consistency in production across its divisions. Within this legacy, Vishal Nirmiti Limited brings over 32 years of specialized experience in infrastructure manufacturing, combining group heritage with sector-focused expertise to support India's growing infrastructure landscape.

Key products & Services:

Category	Description
Railway Infrastructure	• Pre-Stressed Concrete (PSC) Sleepers: VNL manufactures PSC sleepers that are widely used in railway track infrastructure, ensuring durability and stability for heavy rail operations. • Railway Noise Barriers: The company supplies noise barrier systems designed for railway corridors, contributing to improved urban infrastructure and sound control.
MS Pipelines	• Longitudinal Submerged Arc Welded (LSAW): VNL manufactures Longitudinal Submerged Arc Welded (LSAW) pipes, engineered for strength, consistency, and durability in high-pressure environments. Specifications- ➤ Diameter Range: 219 mm to 1625 mm ➤ Wall Thickness: 6.35 mm to 60 mm ➤ Length: 2 m to 18 m Applicable Standards: API 5L PSL1 / PSL2, ASTM A53 / A252, EN 10219-1 / EN 10217-1 • Helically Submerged Arc Welded (HSAW): VNL manufactures Helically Submerged Arc Welded (HSAW) pipes, designed to deliver exceptional flexibility, strength, and reliability across a wide range of infrastructure applications. Produced using advanced spiral welding techniques, these pipes provide consistent performance in projects requiring large diameters and high structural integrity. Specifications- ➤ Diameter Range: 457 mm to 2540 mm

	➤ Wall Thickness: Up to 25.4 mm ➤ Length: 6 m to 13 m Applicable Standards: API 5L, ASTM, EN 10217, GB/T9711
Structural Work (Services)	• Coating: VNL provide specialized pipe coating solutions to protect Mild Steel (MS) pipelines from corrosion, environmental stress, and mechanical damage. These coatings are applied to both HSAW and LSAW pipes used in critical applications such as oil & gas transportation, water transmission, and structural infrastructure. • Design & Fabrication of Gates & Penstocks • Installation & Commissioning of Hydro Mechanical Equipment • Maintenance & Refurbishment Services

Key Client segments:

- **Railway Infrastructure Sector:** VNL supplies PSC sleepers, noise barriers, and related concrete elements for railway networks, serving the needs of track development, modernization, and noise control.
- **Pipeline and Energy Sector:** Through its LSAW and HSAW pipes (with coating) and fabricated MS pipes, the company caters to oil, gas, and water pipeline projects, supporting utilities and energy infrastructure.
- **Water Resource & Hydropower Sector:** The hydro-mechanical equipment manufactured by VNL is utilized in irrigation systems, dams, and hydropower projects, addressing requirements in water management and renewable energy.
- **Industrial and Structural Fabrication Sector:** By offering steel forming, welding, and coating solutions along with structural works, VNL supports large-scale industrial projects and heavy engineering applications.
- **Civil Construction & Infrastructure Development:** The company engages in building roads, flyovers, bridges, and buildings, thereby serving public sector projects, urban development bodies, and construction contractors.

Key Strengths:

- **Diversified Product Portfolio:** The company offers a wide range of products including PSC sleepers, concrete elements, MS pipes, LSAW and HSAW coated pipes, hydro-mechanical equipment, and noise barriers, allowing it to serve multiple infrastructure sectors.

- **Expertise in Civil Construction:** In addition to manufacturing, VNL undertakes infrastructure development projects such as roads, flyovers, bridges, and buildings, giving it an integrated role across construction and fabrication.
- **Strong Manufacturing Infrastructure:** The company operates facilities across India, equipped with advanced forming, welding, and coating technologies, enabling production that meets Indian as well as international standards.
- **Geographic Presence with Multiple Offices:** With its corporate head office in Pune, registered office in Mumbai, and an additional office in Nagpur, VNL maintains an operational presence that enables effective client coordination and project management across regions.

Financial Analysis:

Particulars	Vishal Nirmiti Limited			Indian Hume Pipe Company Limited			GPT Infraprojects Limited (Consolidated)		
	FY 2026	FY 2025	FY 2024	FY 2026	FY 2025	FY 2024	FY 2026	FY 2025	FY 2024
Revenue from operations (₹ Lakhs)	33,867.73	31,851.62	24,288.20	1,30,556.83	1,49,123.14	1,38,863.57	1,28,991.69	1,18,807.14	1,01,828.38
EBITDA (₹ Lakhs)	5,112.97	4,648.35	2,314.25	14,572.61	18,617.49	17,267.64	17,417.83	13,552.37	12,104.57
EBITDA Margins (%)	15.10%	14.59%	9.53%	11.16%	12.48%	12.43%	13.50%	11.41%	11.89%
Restated Profit/(loss) after tax ("PAT") (₹ Lakhs)	2497.5	2363.59	344.56	14111.06	55805.24	7762.78	9632.59	7492.94	5651.64
PAT Margins (%)	7.37%	7.42%	1.42%	10.81%	37.42%	5.59%	7.47%	6.31%	5.55%
Earnings per Equity Share (EPS) - Basic (₹)	12.61	11.94	1.74	26.79	105.93	15	7.7	6.55	4.97
Debt-Equity Ratio (Total Debt/ Equity) (No. of times)	1.01	1.43	2.37	0.28	0.33	0.60	0.49	0.24	0.62
Return on Equity (%)	33.67%	47.21%	9.37%	9.86%	50.60%	10.18%	17.10%	18.14%	19.49%
Return on Capital Employed (%)	28.03%	30.32%	14.65%	9.01%	9.88%	12.60%	18.17%	19.10%	22.76%
Growth in Revenue from Operations (%)	6.33%	31.14%	-8.91%	-12.45%	7.39%	-10.00%	8.57%	16.67%	25.85%
Fixed Assets Turnover Ratio	4.28	5.03	4.86	9.62	10.70	14.09	6.22	7.64	8.23
Net Worth	8634.4	6112.27	3812.38	148435.98	137666.73	82925.8	60280.37	52353.21	30264.59
Capital Employed	17,420.05	14,961.37	12,987.67	1,89,527.34	1,82,616.74	1,32,893.09	89,682.80	65,021.50	49,135.69
Net Cash from/ (used in) Operating Activities	2,715.47	3,820.17	2,773.05	29,365.09	20,392.61	1,943.53	6,426.59	2,887.81	11,338.78
Bill to book ratio	49.35%	84.07%	69.99%	NA*	NA	NA	28.82%	34.08%	32.86%

Source: All the for financial information for listed industry peers mentioned above is on a consolidated basis and is sourced from the annual reports/financial statements as available of the respective company for the year ended March 31, 2025, March 31, 2024, and March 31, 2023, submitted to stock exchanges website. (* Not Annualised

*Not Available

Notes:

1. Revenue from Operations means Revenue from sale of products, sale of services and other operating income.
2. EBITDA is calculated as the sum of Restated Profit/(loss) after tax, total tax expense, finance cost, and depreciation and amortization expense, minus other income and exceptional items.
3. EBITDA margin is calculated as EBITDA divided by Revenue from Operations.
4. Restated profit/(loss) after tax means the profit/(loss) after tax as appearing in the Restated Financial Statements
5. PAT Margin is calculated as Restated Profit/(loss) after tax divided by Revenue from Operations.
6. Earnings per Equity Share (EPS) - Basic (₹) is the profit attributable to owners of the Company divided by the weighted average number of shares.
7. Debt-Equity Ratio is calculated as Total Borrowing is divided by Total Equity. Total debt is the sum of total current & non-current borrowings including interest accrued but not due; total equity means the aggregate value of the paid-up equity share capital and other equity.
8. Return on Equity attributable to owners of the Company, is calculated by dividing the Restated Profit/(loss) for the year attributable to Owners of the Company by the Average of total equity attributable to owners of the Company. The average is obtained by adding the Total Equity attributable to owners of the Company at the beginning and end of the year and dividing by 2.
9. Return on Capital Employed, also expressed as a percentage, is calculated by dividing EBIT by Capital Employed. EBIT is the sum of restated profit/(loss) after tax, total tax expense, finance costs and deducted exceptional items. Capital Employed is calculated as sum of total equity and total borrowings.
10. Growth in Revenue from Operations (%) is calculated as Revenue from Operations of the relevant period minus Revenue from Operations of the preceding period, divided by Revenue from Operations of the preceding period.
11. Fixed Asset Turnover Ratio: This is defined as revenue from operations divided by total of net block property, plant & equipment. Figures for property, plant & equipment do not include capital work-in-progress and intangible assets.
12. Net worth means aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account and debit or credit balance of profit and loss account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the Restated Financial Statements but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation.
13. Capital Employed is calculated as sum of total equity and total borrowings
14. Net Cash from/ (used in) Operating Activities is a measure of the cash generated or used by a company's core operations, excluding any financing or investing activities
15. Bill to book ratio is calculated as Revenue from operations for that period excluding Provision for Escalation & Other operating revenue divided by the Order Book as at a particular period