CareEdge
ANALYTICS & ADVISORY
A subsidiary of CARE Ratings Ltd.

Research Report on Construction Engineering

March 27, 2025

Disclaimer

This report is prepared by CARE Analytics and Advisory Private Limited (CareEdge Research). CareEdge Research has taken utmost care to ensure accuracy and objectivity while developing this report based on information available in CareEdge Research's proprietary database, and other sources considered by CareEdge Research as accurate and reliable including the information in public domain. The views and opinions expressed herein do not constitute the opinion of CareEdge Research to buy or invest in this industry, sector or companies operating in this sector or industry and is also not a recommendation to enter any transaction in this industry or sector in any manner whatsoever.

This report must be seen in its entirety; the selective review of portions of the report may lead to inaccurate assessments. All forecasts in this report are based on assumptions considered to be reasonable by CareEdge Research; however, the actual outcome may be materially affected by changes in the industry and economic circumstances, which could be different from the projections.

Nothing contained in this report is capable or intended to create any legally binding obligations on the sender or CareEdge Research which accepts no responsibility, whatsoever, for loss or damage from the use of the said information. CareEdge Research is also not responsible for any errors in transmission and specifically states that it, or its Directors, employees, parent company – CARE Ratings Ltd., or its Directors, employees do not have any financial liabilities whatsoever to the subscribers/users of this report. The subscriber/user assumes the entire risk of any use made of this report or data herein. This report is for the information of the authorized recipient in India only and any reproduction of the report or part of it would require explicit written prior approval of CareEdge Research.

CareEdge Research shall reveal the report to the extent necessary and called for by appropriate regulatory agencies, viz., SEBI, RBI, Government authorities, etc., if it is required to do so. By accepting a copy of this Report, the recipient accepts the terms of this Disclaimer, which forms an integral part of this Report.

Table of Contents

List of Charts

List of Tables

Abbreviations

Abbreviations	
3PL	Third Party Logistics
AI	Artificial Intelligence
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AS/RS	Automated storage and retrieval systems
BE	Budget Estimates
BIM	Building Information Modelling
BIS	Bureau of Indian Standards
Bn	Billions
BOP	Balance of Payments
BOQ	Bill of Quantities
BREEAM	Building Research Establishment Environmental Assessment Method
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism
CEA	Central Electricity Authority
CKm	Circuit Kilometer
CNC	Computer Numerical Control
CPI	Consumer Price Index
CSR	Corporate Social Responsibility
CY	Calendar Year
DFI	Development Finance Institution
DMIC	Delhi-Mumbai Industrial Corridor
DPIIT	Department for Promotion of Industry and Internal Trade
DPR	Detailed Project Report
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EIA	Environmental Impact Assessment
EPC	Engineering Procurement and Construction
ESG	Environmental, Social, and Governance
ETS	Emissions Trading System
EU	European Union
EV	Electric Vehicles
EVIA	Environmental Impact Assessment
FAE	First Advance Estimates
FAT	Factory Acceptance Testing
FDI	Foreign Direct Investment

FRE	First Revised Estimates
FY	Financial Year
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GIS	Geographic Information System
GMV	Gross Merchandise Value
GNDI	Gross National Disposable Income
GST	Goods and Services Tax
GVA	Gross Value Added
HSE	Health, Safety, and Environment
HVAC	Heating, Ventilation, and Air Conditioning
IEC	International Electrotechnical Commission
IGBC	Indian Green Building Council
IIP	Index of Industrial Production
IMF	International Monetary Fund
INR	Indian Rupee
IoT	Internet of Things
IPR	Intellectual Property Rights
IS	Indian Standards
ISRO	Indian Space Research Organisation
ITC	Input Tax Credit
ITR	Income Tax Return
JSW	Jindal South West
KPI	Key Performance Indicator
KPIL	Kalpataru Projects International Limited
Kv	kilovolt
L&T	Larsen & Toubro Limited
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LPI	Logistics Performance Index
MEL	Macmet Engineering Limited
MHE	Material Handling Equipment
MHS	Material Handling Systems
MIG	Metal Inert Gas
MLP	Mobile Launch Pedestals
Mn	Millions
MoEF	Ministry of Environment and Forests
MOSPI	Ministry of Statistics and Programme Implementation
MPC	Monetary Policy Committee
MVA	Mega Volt Ampere
NAPCC	National Action Plan on Climate Change
NBC	National Building Code
NEC	National Electric Code
NEMMP	National Electric Mobility Mission Plan
NIP	National Infrastructure Pipeline
NMP	National Monetization Pipeline
OEM	Original Equipment Manufacturer

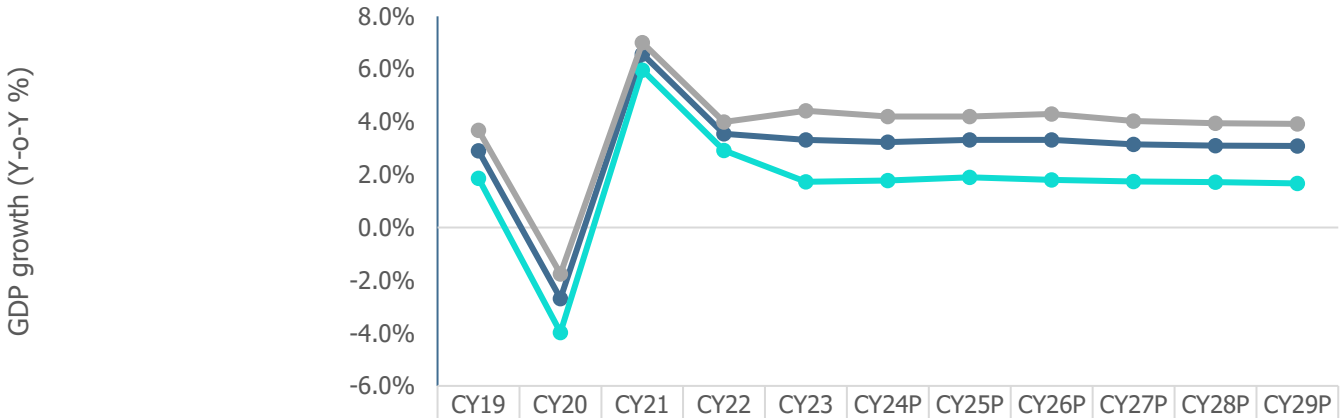
OPEX	Operational Expenditure
PAT	Perform, Achieve, and Trade
PEB	Pre - Engineered Building
PFB	Prefabricated Buildings
PFCE	Private Final Consumption Expenditure
PGCIL	Power Grid Corporation of India Limited
PHE	Public Health Engineering
PIF	PSLV Integration Facilities
PLI	Production Linked Incentive
PMAY	Pradhan Mantri Awas Yojana
PMC	Project Management Consultancy
PMI	Purchasing Managers' Index
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
PPA	Power Purchase Agreement
Q-commerce	Quick Commerce
RBI	Reserve Bank of India
RE	Revised Estimates
REIT	Real Estate Investment Trust
RERA	Real Estate Regulation Act
ROCE	Return on Capital Employed
RoE	Return on Equity
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SERC	State Electricity Regulatory Commissions
SEZ	Special Economic Zone
SME	Small & Medium Enterprises
SOP	Standard Operating Procedure
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TCO	Total Cost of Ownership
TIG	Tungsten Inert Gas
UPI	Unified Payments Interface
USD	US Dollar
WEO	World Economic Outlook
WRDA	Warehousing Regulatory and Development Authority
Y-O-Y	Year- On- Year Growth

1. Economic Outlook

1.1 Global Economy

Global growth, which reached 3.3% in CY23, is projected to stabilize at 3.2% for CY24 and 3.3% for CY25. The outlook for global real GDP growth indicates potential improvement as cyclical imbalances ease, bringing economic activity in major economies closer to their potential output. While global disinflation progresses, risks remain, particularly from financial market volatility and geopolitical tensions that could disrupt trade and increase commodity prices. Nonetheless, stronger public investment in advanced economies aimed at infrastructure and the green transition may stimulate private sector investment and bolster global demand. Additionally, accelerating structural reforms in both advanced and emerging markets could enhance productivity and support medium-term growth.

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



	CY19	CY20	CY21	CY22	CY23	CY24P	CY25P	CY26P	CY27P	CY28P	CY29P
World	2.9%	-2.7%	6.6%	3.6%	3.3%	3.2%	3.3%	3.3%	3.2%	3.1%	3.1%
Advanced Economies	1.9%	-4.0%	6.0%	2.9%	1.7%	1.8%	1.9%	1.8%	1.7%	1.7%	1.7%
Emerging Market and Developing Economies	3.7%	-1.8%	7.0%	4.0%	4.4%	4.2%	4.2%	4.3%	4.0%	3.9%	3.9%

Notes: P-Projection; Source: IMF – World Economic Outlook, January 2025

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

	Real GDP (Y-o-Y change in %)									
	CY20	CY21	CY22	CY23	CY24P	CY25P	CY26P	CY27P	CY28P	CY29P
India	-5.8	9.7	7.0	8.2	7.0	6.5	6.5	6.5	6.5	6.5
China	2.2	8.4	3.0	5.3	4.8	4.6	4.5	3.6	3.4	3.3
Indonesia	-2.1	3.7	5.3	5.0	5.0	5.1	5.1	5.1	5.1	5.1
Saudi Arabia	-3.6	5.1	7.5	-0.8	1.5	3.3	4.1	3.6	3.5	3.5
Brazil	-3.3	4.8	3.0	2.9	3.0	2.2	2.2	2.4	2.5	2.5
Euro Area	-6.1	6.2	3.3	0.4	0.8	1.0	1.4	1.4	1.3	1.2

United States	-2.2	6.1	2.5	2.9	2.8	2.7	2.1	2.1	2.1	2.1

P- Projections; Source: IMF- World Economic Outlook Database (October 2024, January 2025)

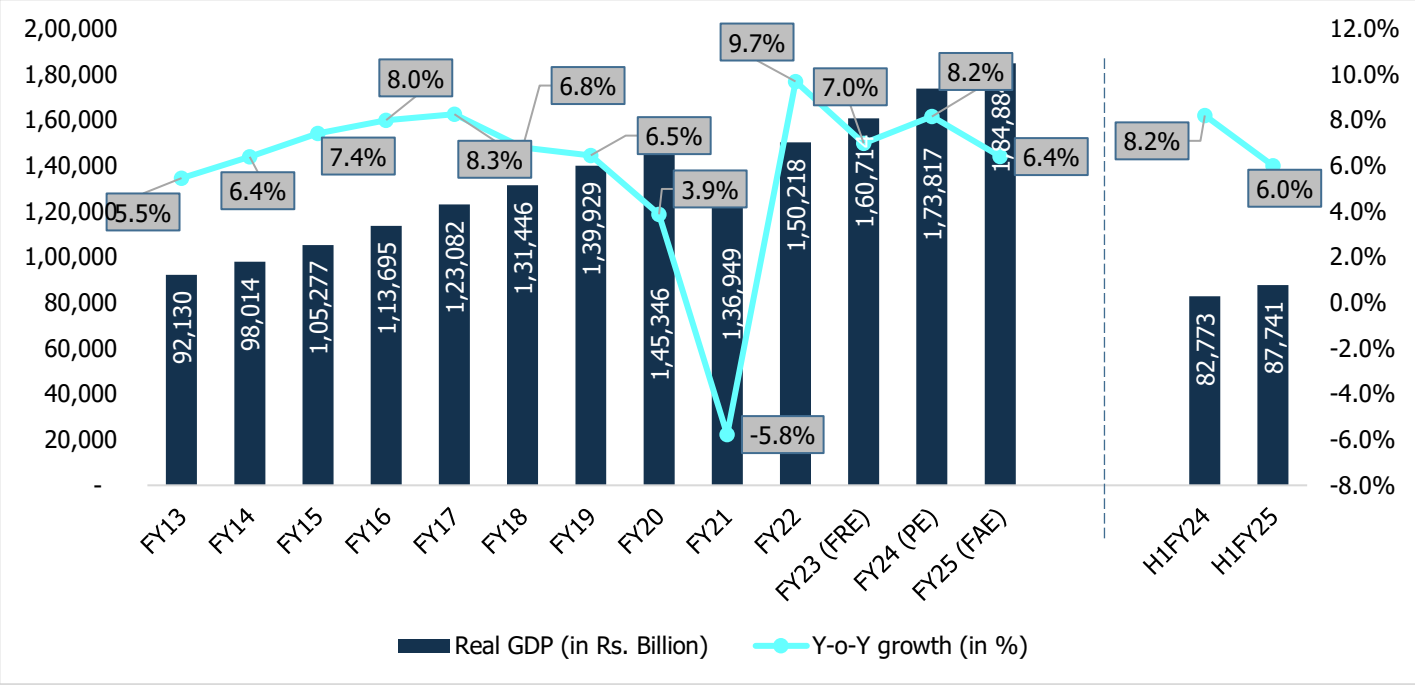
Note: CY20-CY26 data is taken from January 2025 IMF WEO report, while CY27-CY29 data is taken from October 2024 database, as this update is yet to come. India's fiscal year (FY) aligns with the IMF's calendar year (CY). For instance, FY24 corresponds to CY23.

1.2 Indian Economic Outlook

1.2.1 GDP Growth and Outlook

Resilience to External Shocks remains Critical for Near-Term Outlook

Chart 2: Trend in Real Indian GDP growth rate



Note: FRE – First Revised Estimates, PE – Provisional Estimate, FAE- First Advance Estimates; Source: MOSPI

India's real GDP grew by 8.2% in FY24 (Rs. 173,817 billion) and is estimated to grow 6.4% in FY25 (Rs. 184,884 billion), driven by strong domestic demand, particularly investment. In H1FY25, GDP grew 6.0% YoY, with private consumption increasing by 6.7% and government spending contracting by 2.0%.

GDP Growth Outlook

- **FY26 GDP Outlook:** Real GDP growth is projected at 6.7%, balanced risks, driven by rural demand, improving employment, and robust business activity, despite global uncertainties.
- **FY25 GDP Performance:** Real GDP growth for the current year is estimated at 6.4%, with a gradual recovery expected in the coming year driven by strong agricultural activity, improving manufacturing, and resilient services, despite a slight dip in PMI services.

Persistent geopolitical tensions, volatility in international financial markets and geo-economic fragmentation do pose risk to this outlook. Based on these considerations, the RBI, in its February 2025 monetary policy, has projected real GDP growth at 6.7% y-o-y for FY26.

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

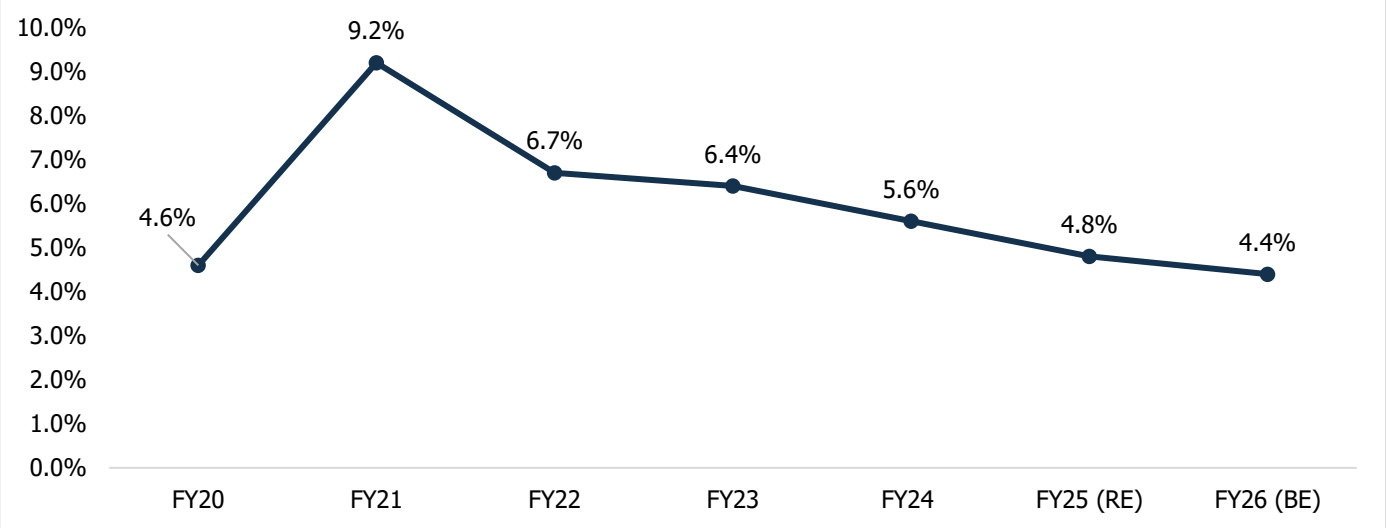
FY26P (complete year)	Q1FY26P	Q2FY26P	Q3FY26P	Q4FY26P
6.7%	6.7%	7.0%	6.5%	6.5%

Note: P-Projected; Source: Reserve Bank of India

1.2.2 Fiscal Deficit (as a % of GDP)

In FY21, India's fiscal deficit was 9.2% due to the impact of COVID-19, but by FY25 (RE), it is expected to reduce to 4.8% of GDP, driven by strong economic growth and higher tax and non-tax revenues. The government aims for further fiscal consolidation, setting a target of 4.4% of GDP for FY26 to maintain fiscal prudence.

Chart 3: Gross Fiscal Deficit (% of GDP)

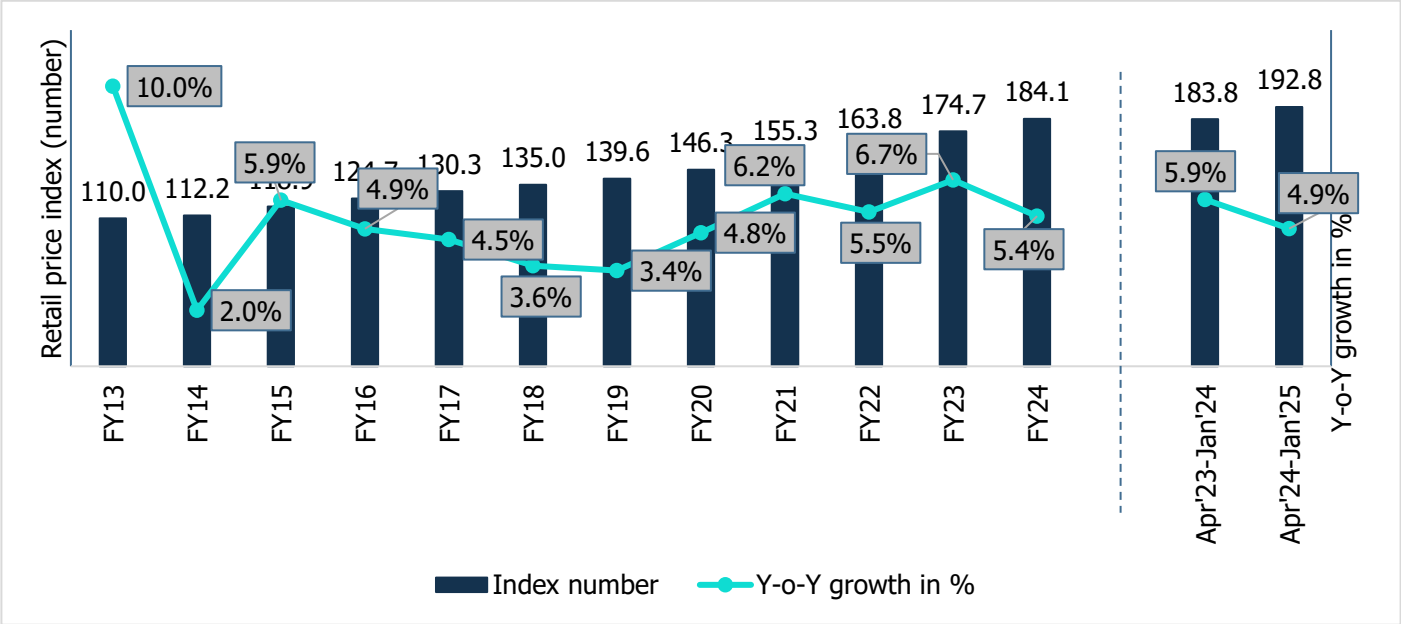


Note: RE-Revised Estimates, BE-Budget Estimates; Source: RBI

1.2.3 Consumer Price Index

The CPI (general) and food inflation in January 2025 was the lowest in Y-o-Y inflation after August 2024. CPI moderation was driven by decline in inflation in Vegetables, Eggs, Pulses, Education, Clothing, Health and Cereals etc.

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

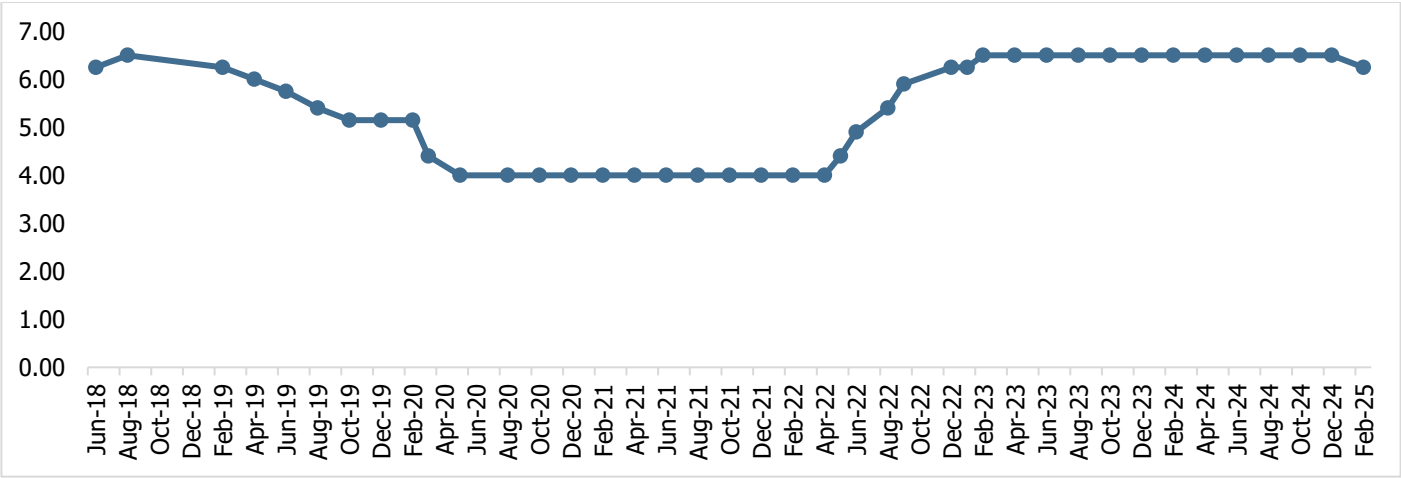


Source: MOSPI

The CPI is primarily factored in by RBI while preparing their bi-monthly monetory policy. At the bi-monthly meeting held in February 2025, RBI projected inflation at 4.2% for FY25 with inflation during Q1FY26 at 4.2%, Q2FY25 at 4.5%, Q1FY26 at 4.6%, and Q3FY26 at 3.8% and Q4FY26 4.2%.

Considering the current inflation situation, RBI has cut the repo rate to 6.25% in the February 2025 meeting of the Monetary Policy Committee.

Chart 5: RBI historical Repo Rate



Source: RBI

Further, the central bank continued its stance to be neutral. While headline inflation saw a sharp pick up due to increase in food inflation in October, it has moderated in December and January. The growth outlook is expected to be resilient but with close monitoring with the Indian ruppee coming under depreciation in the current months. Core inflation is expected to rise but remain moderate. Domestic growth remains strong, driven by private consumption and investment,

allowing the MPC to focus on bringing inflation down to the 4% target. As a result, the MPC decided to adopt a 'neutral' stance, monitoring inflation while supporting growth.

1.2.4 GVA in the Industrial Sector

Gross Fixed Capital Formation (GFCF) is a measure of the net increase in physical assets. In FY23, the ratio of investment (GFCF) to GDP remained flat, as compared to FY22, at 33.3%. Continuing in its growth trend by a margin, this ratio has reached 33.5% in FY24 and 30.1% in FY25. In H1FY25, GFCF as a proportion in GDP, reached 31.0% as compared to 31.4% in H1FY24 mainly reflecting growth in private investment.

Table 3: Industrial sector growth (Y-o-Y growth) -at Constant Prices

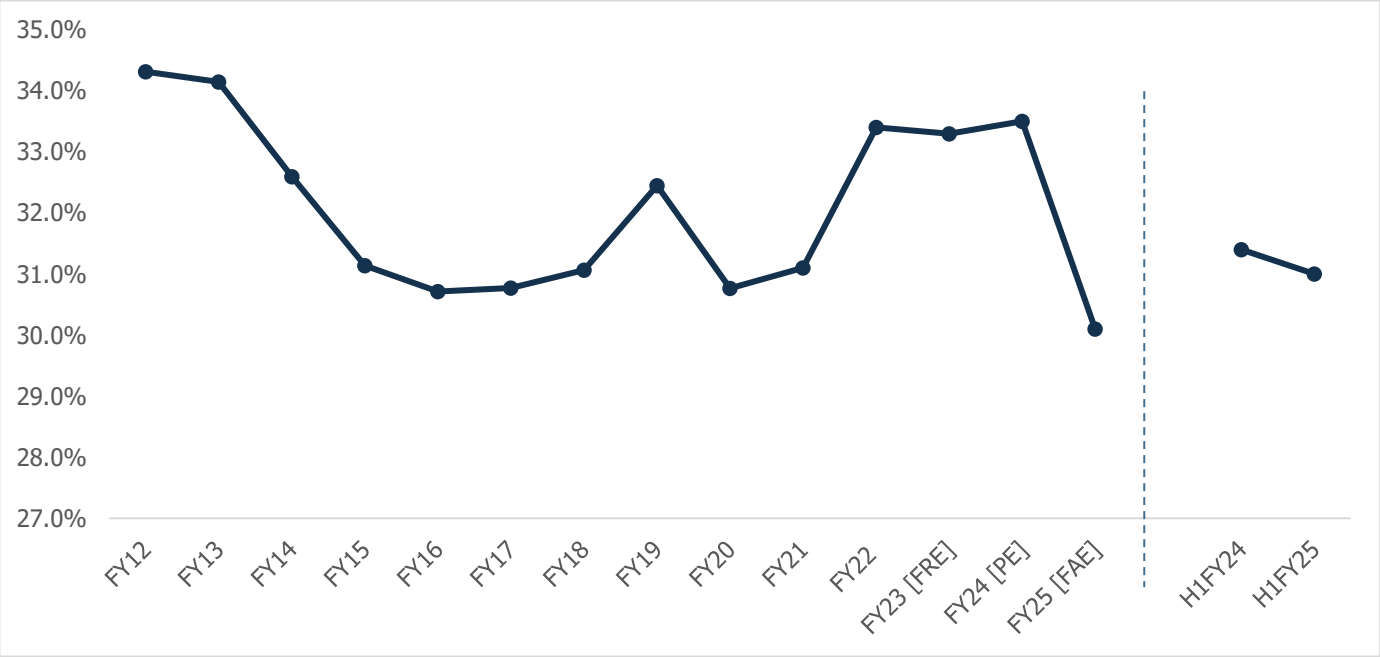
At constant Prices	FY19	FY20	FY21	FY22	FY23 (FRE)	FY24 (PE)	FY25 (FAE)	H1FY24	H1FY25
Industrial sector	5.3	-1.4	-0.9	11.6	2.1	9.5	6.2	9.7	6.0
GVA at Basic Price	**5.8**	**3.9**	**-4.2**	**8.8**	**6.7**	**7.2**	**6.4**	**8.0**	**6.2**

Note: FRE – First Revised Estimates, PE – Provisional Estimate, FAE- First Advance Estimates; Source: MOSPI

1.2.5 Investment Trend in Infrastructure

Gross Fixed Capital Formation (GFCF) is a measure of the net increase in physical assets. In FY23, the ratio of investment (GFCF) to GDP remained flat, as compared to FY22, at 33.3%. Continuing in its growth trend, this ratio has reached 33.5% in FY24. In H1FY25, GFCF as a proportion in GDP, reached 31.0% as compared to 31.4% in H1FY24 mainly reflecting growth in private investment.

Chart 6: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices)



Note: FRE- First Revised Estimates, PE – Provisional Estimate, FAE-First Advance Estimate; Source: MOSPI

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

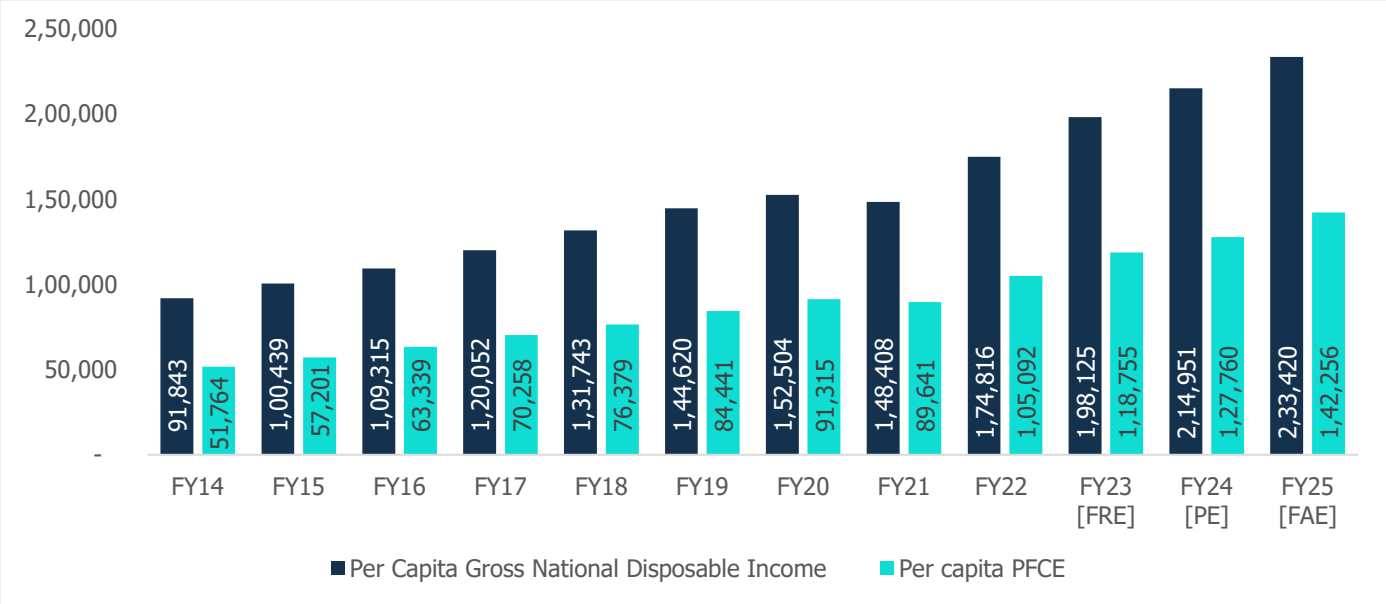
1.2.6 Per capita PFCE and GNDI

- **Increasing Disposable Income and Consumer Spending**

Gross National Disposable Income (GNDI) is a measure of the income available to the nation for final consumption and gross savings. Between the period FY14 to FY25, per capita GNDI at current prices registered a CAGR of 8.85%. More disposable income drives more consumption, thereby driving economic growth.

With increase in disposable income, there has been a gradual change in consumer spending behaviour as well. Private Final Consumption Expenditure (PFCE) which is measure of consumer spending has also showcased significant growth from FY14 to FY25 at a CAGR of 9.63%.

Chart 7: Trend of Per Capita GNDI and Per Capita PFCE (Current Price)



Note: FAE- First Advance Estimates, FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

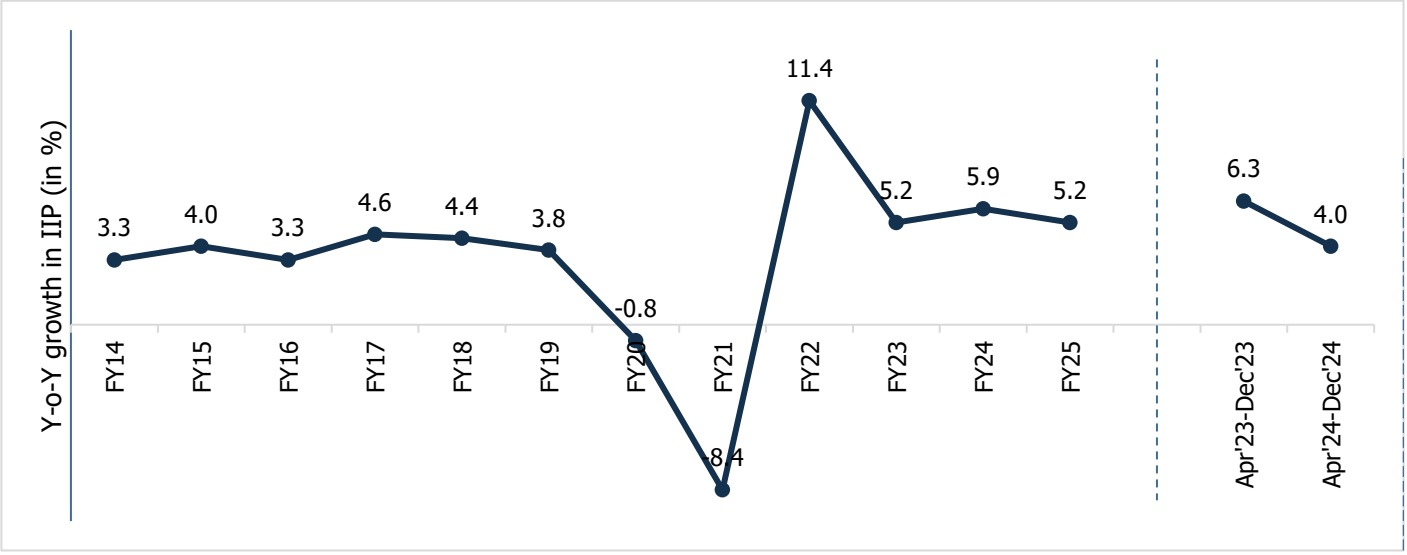
1.2.7 Industrial Growth

Improved Core and Capital Goods Sectors helped IIP Growth Momentum

The slowdown in industrial output from April to December 2024 was primarily due to weaker growth in manufacturing, despite strong government infrastructure spending and rising private investment. Key contributors to growth in December 2024 were primary goods, infrastructure/ construction goods and intermediate goods. The manufacturing sector's decline was influenced by reduced production in sectors like basic metals, electrical equipment, and petroleum products.

Manufacturing growth was driven by basic metals, electrical equipment, and coke and refined petroleum products. While government spending and private investment support growth, declining consumer non-durables and improving rural demand highlight the need for sustained consumption and investment.

Chart 8: Y-o-Y growth in IIP (in %)



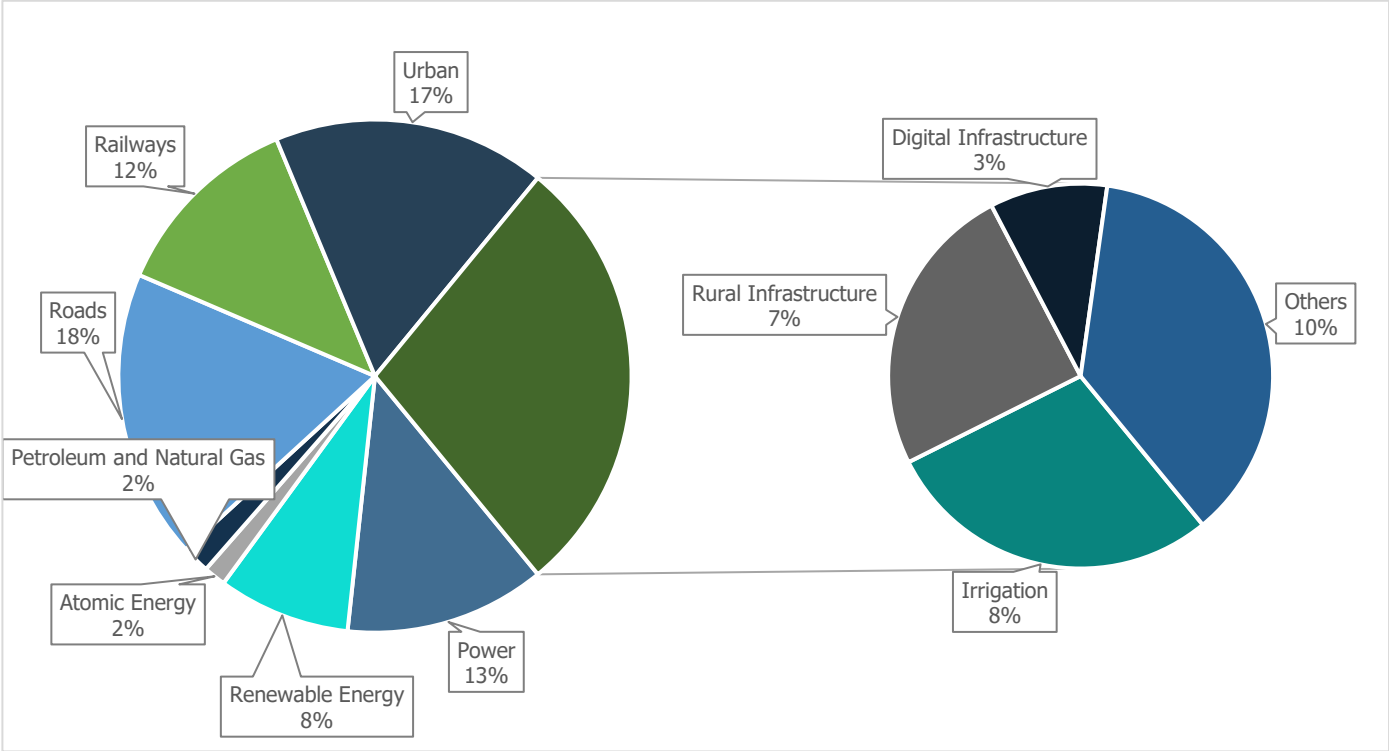
Source: MOSPI

1.2.8 National Infrastructure Pipeline

NIP was launched in December 2019 with a focus on infrastructure development to enable the country to achieve its target of USD 5 trillion economy by FY25 and USD 10 trillion by FY30. Infrastructure to play a major role with 3% contribution to the GDP by FY25 (Rs 11.21 lakh crore) and is expected to remain same or increase its share by FY30 (Rs 25.00 lakh crore).

A taskforce was created to set up the pipeline. In the final report submitted by the task force in April 2020, the pipeline covers multiple sectors, such as urban infrastructure, renewable and conventional energy, roads and railways that constitute nearly 71% of the projected total capex of Rs 11.21 lakh crore. It also includes investments in other sectors such as rural infrastructure, ports, airports among others. The proposed investments will be implemented by both the government and the private sector.

Chart 9: National Infrastructure Pipeline Sectoral Split (%)



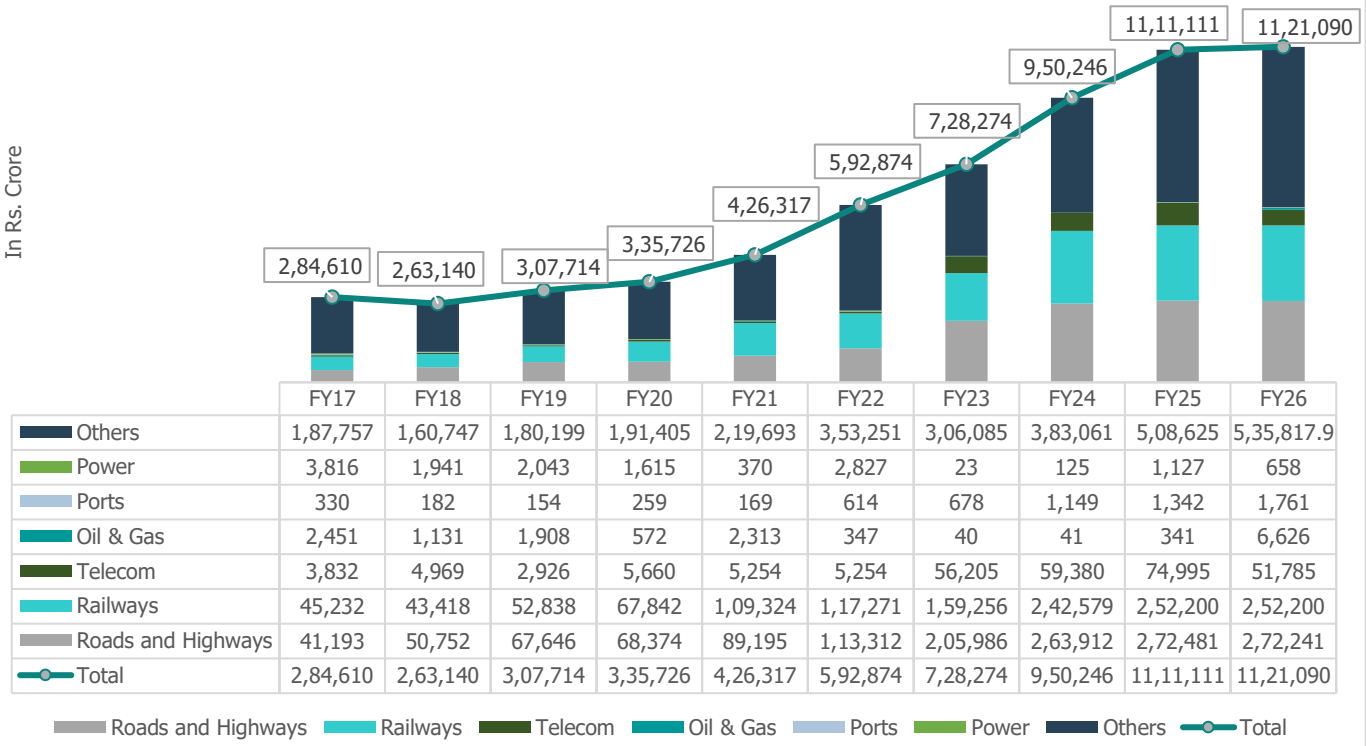
Source: NITI Aayog's report on National Infrastructure Pipeline

During FY20–25, sectors-wise breakup of NIP investment is with energy contributing the highest at Rs 26,900 billion around 24% of the total plan followed by roads Rs. 20,338 billion at 18%, urban Rs. 19,193 billion at 17%, and railways with an investment of Rs. 13,676 billion, which contributes 12% amount to ~71% of the projected infrastructure investments in India.

1.2.9 Budgetary expenditure on Infrastructure

With the growing population, the long-term need for robust infrastructure is necessary for economic development. This generates the need for massive investments in the development and modernization of infrastructure facilities, which will not only cater to the growing demand but will also ensure competitiveness in the global market.

Chart 10: Budgetary outlay towards infrastructure



	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26
Others	1,87,757	1,60,747	1,80,199	1,91,405	2,19,693	3,53,251	3,06,085	3,83,061	5,08,625	5,35,817.9
Power	3,816	1,941	2,043	1,615	370	2,827	23	125	1,127	658
Ports	330	182	154	259	169	614	678	1,149	1,342	1,761
Oil & Gas	2,451	1,131	1,908	572	2,313	347	40	41	341	6,626
Telecom	3,832	4,969	2,926	5,660	5,254	5,254	56,205	59,380	74,995	51,785
Railways	45,232	43,418	52,838	67,842	1,09,324	1,17,271	1,59,256	2,42,579	2,52,200	2,52,200
Roads and Highways	41,193	50,752	67,646	68,374	89,195	1,13,312	2,05,986	2,63,912	2,72,481	2,72,241
Total	2,84,610	2,63,140	3,07,714	3,35,726	4,26,317	5,92,874	7,28,274	9,50,246	11,11,111	11,21,090

Source: Union Budget FY26 document

Some of the key government infrastructure schemes include:

- The government has announced plans for the National Monetization Pipeline (NMP) and Development Finance Institution (DFI) to improve the financing of infrastructure projects
- The government has helped the growth of urbanization through a number of schemes and projects, including the **Smart Cities Mission,** the **Atal Mission for Rejuvenation and Urban Transformation (AMRUT),** and the **Pradhan Mantri Awas Yojana (Urban)**

1.2.10 Overview of rise in steel consumption in India

Steel is used in industries like energy, construction, automotive, transportation, infrastructure, packaging, and machinery. There was a strong recovery in finished steel consumption post-COVID-19. In developed economies like the USA, Europe, Japan, and South Korea, the demand was driven by the automotive and durable goods sectors.

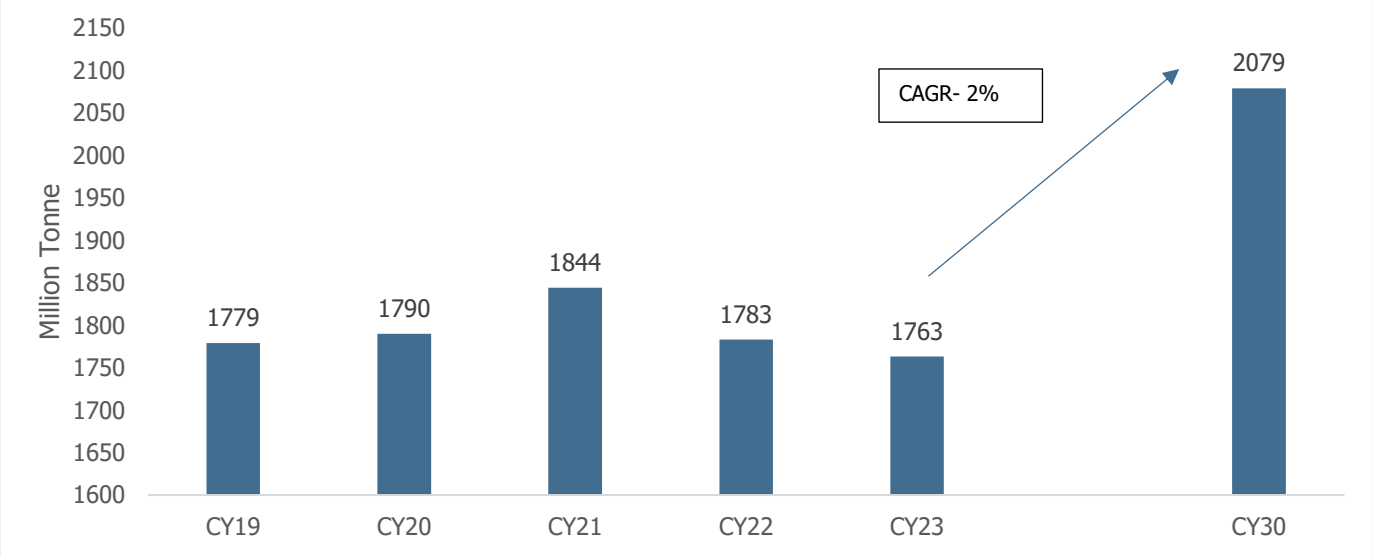
The global finished steel consumption has increased at a CAGR of 1.8% from 1,779 MT in CY19 to 1,844 MT in CY21. During the period CY21-CY23, it declined at a CAGR of 2.2% to 1,763 MT in CY23.

The global consumption of finished steel declined by 3.3% y-o-y in CY22, because global production was affected due to a slowdown in China, monetary tightening in the United States and Europe, inflationary pressures which raised input costs, and disruptions in supply chain due to the Russia-Ukraine war.

Further, the finished steel consumption in China was reduced on account of movement restrictions and lockdowns brought by COVID-19, environmental concerns, and the target to lower carbon emissions. However, government support is expected to aid in the recovery of demand with the resumption of construction and real estate activities.

Moreover, the consumption of finished steel in India has been robust given increased investments in infrastructure and policy support by the government. Despite the inflationary pressures and uncertainties around the global economy, India witnessed a healthy demand from auto, consumer durables, capital goods, and real estate sectors. Further, the finished steel demand fell by 1.1% y-o-y in CY23 globally. While India showed resilience in terms of growth in steel demand, regions like EU, United States, and China faced a downturn in steel demand. The steel demand is expected to grow by 2% till CY30 to reach 2,079 Million tonnes.

Chart 11: Global Steel Demand



Source: World Steel Association, IEA, CareEdge Research

2. Overview of construction capex in India

2.1 Construction capex in India

India's economic growth is fuelled by a diverse range of sectors, of which infrastructure is a vital sector. The Indian infrastructure contributes around 5% to the GDP as of FY24. In recent years, the government has taken several steps to accelerate infrastructure development, wherein, the key focus areas are transportation, energy, smart cities, water, social infrastructure, and digital infrastructure. There have also been efforts to attract foreign investors in the infrastructure sector through policy reforms.

Further, infrastructure projects are often expensive and have a long gestation period. To address this issue, fundraising and generating returns, the government is continuously striving to create a favourable operating environment for its players. Accordingly, national, and state-level agencies like the National Highways Authority of India (NHAI), State-level bodies, and private sector companies (both domestic

c and international), are actively participating in infrastructure development.

The key sectors which are the recipient of good budget allocation in FY24-25 budget allocation are roads, power plants, affordable housing, and public infrastructure. The growth in these sectors is expected to drive the construction sector in India.

Key Capex announcement by the Government of India is-

	Budget Announcement	Capital Expenditure (Rs. Billion)
1.	Infrastructure sector	11,110
2.	PM Awas Yojana Urban 2.0	10,000
3	Road Connectivity Projects	260
4	Power Sector	214

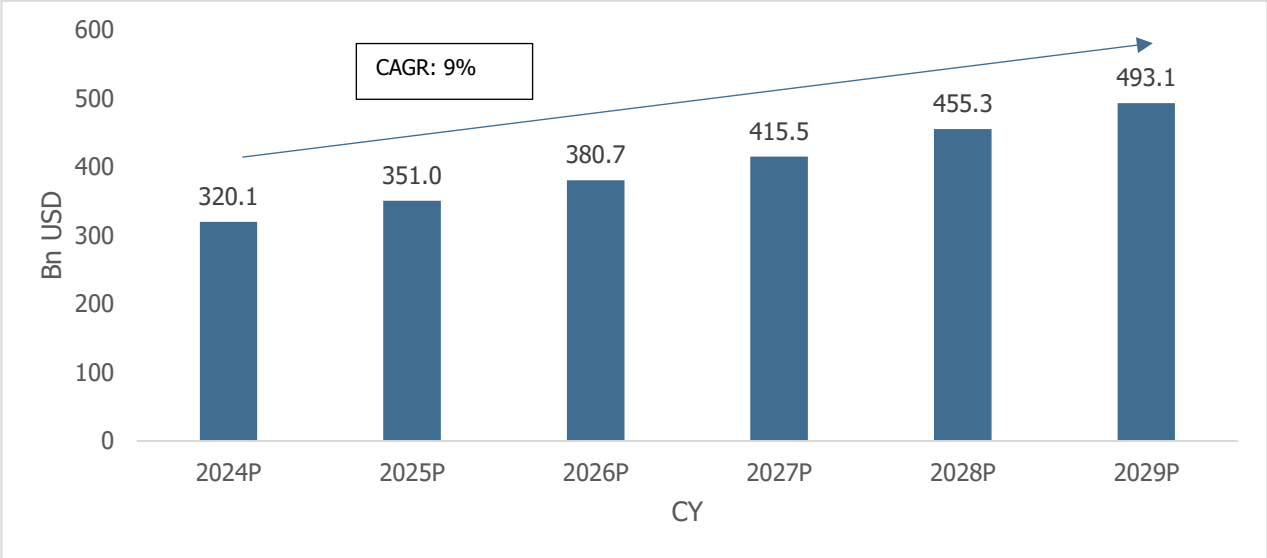
Source: Ministry of Finance

The construction industry in India is one of the largest and most important sectors in the country, playing a key role in driving economic growth, employment, and infrastructure development. It encompasses a wide range of activities including residential, commercial, industrial, and infrastructure projects, such as roads, bridges, railways, airports, and utilities.

The industry's growth is supported by government initiatives such as the Housing for All scheme and the Smart Cities Mission, which aim to enhance urban infrastructure and provide affordable housing. Despite facing challenges like land acquisition, labour issues, and financing constraints, the sector is poised for continued growth, driven by technological advancements and ongoing investments in infrastructure development.

The capital expenditure in India's construction sector has seen significant growth, reflecting the government's commitment to infrastructure development. Moreover, the National Infrastructure Pipeline (NIP) aims for ₹111 trillion (about USD 1.5 trillion) investment in infrastructure projects by 2025, with an expected capex of around ₹30 trillion (approximately USD 363 billion) in the construction sector alone. Private sector participation is also on the rise, with a projected increase in capex from around 25% in previous years to nearly 40% by 2025, indicating growing confidence among investors. Overall, the construction sector's capex is pivotal in driving India's economic growth, with expectations of a CAGR of around 9% in the coming years.

Chart 12: Projected Market Size of Construction Market in India



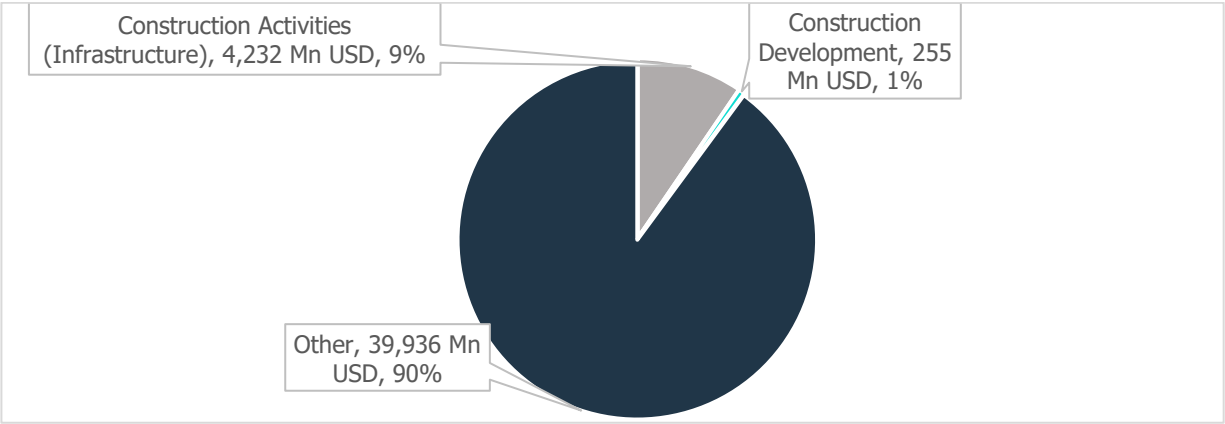
Source: Maia Research, CareEdge Research

2.2 FDI inflows in Industry

Foreign Direct Investment (FDI) plays a pivotal role in shaping the economic landscape and fostering innovation in both developed as well as developing economies. It facilitates global value chains across countries. According to the World Investment Report, 2024 (issued by the United Nations), India and the Association of Southeast Asian Nations were the most buoyant recipients of FDI with an increase of ~10% and ~5%, respectively, in CY22. However, there has been a slight decrease in the FDI inflow in recent years.

The FDI inflow in India has witnessed substantial growth in the past decade. However, in FY24, the FDI equity inflow fell by 22% due to a decline in inflows from traditional sources like Mauritius, USA, and Cayman Island. At the same time, inflows from UAE, Cyprus, and the Netherlands had increased. Broadly, this decline can be attributed to global economic slowdown and hikes in rates by US federals and other central banks.

Chart 13: FDI Equity Inflow in Construction Sector FY24 (Total- 44,423 Mn USD)

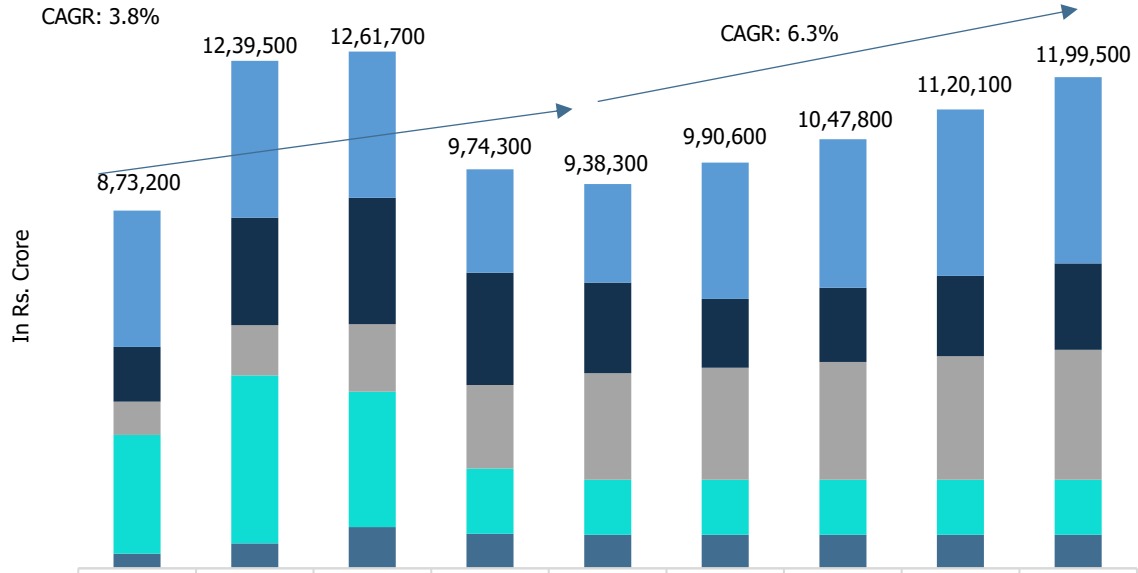


Note: Construction Development includes Townships, Housing, Built-Up Infrastructure and Construction-Development Projects; others include the sectors which have FDI inflow other than construction sector.
Source: Department for Promotion of Industry and Internal Trade (DPIIT)

2.3 Investment Trend in Infrastructure in India

The investment trend in infrastructure in India has been witnessing significant growth, driven by both public and private sector initiatives. In recent years, the government has prioritized infrastructure development through key policies such as the National Infrastructure Pipeline (NIP) and the Gati Shakti National Master Plan. These efforts have focused on improving transportation networks, energy distribution, housing, and urban infrastructure. The growing demand for smart cities, renewable energy projects, and digital infrastructure has attracted substantial private investment. Additionally, the expansion of the capital market has facilitated financing options for large-scale infrastructure projects, fostering public-private partnerships. Foreign direct investment (FDI) in the infrastructure sector has also been rising, further enhancing the sector's potential. With an increasing emphasis on sustainable development and green infrastructure, India is poised to see a long-term boost in infrastructure investments, contributing to its economic growth and global competitiveness.

Chart 14: Continued High Investment Momentum in Indian Key Infrastructure Sectors

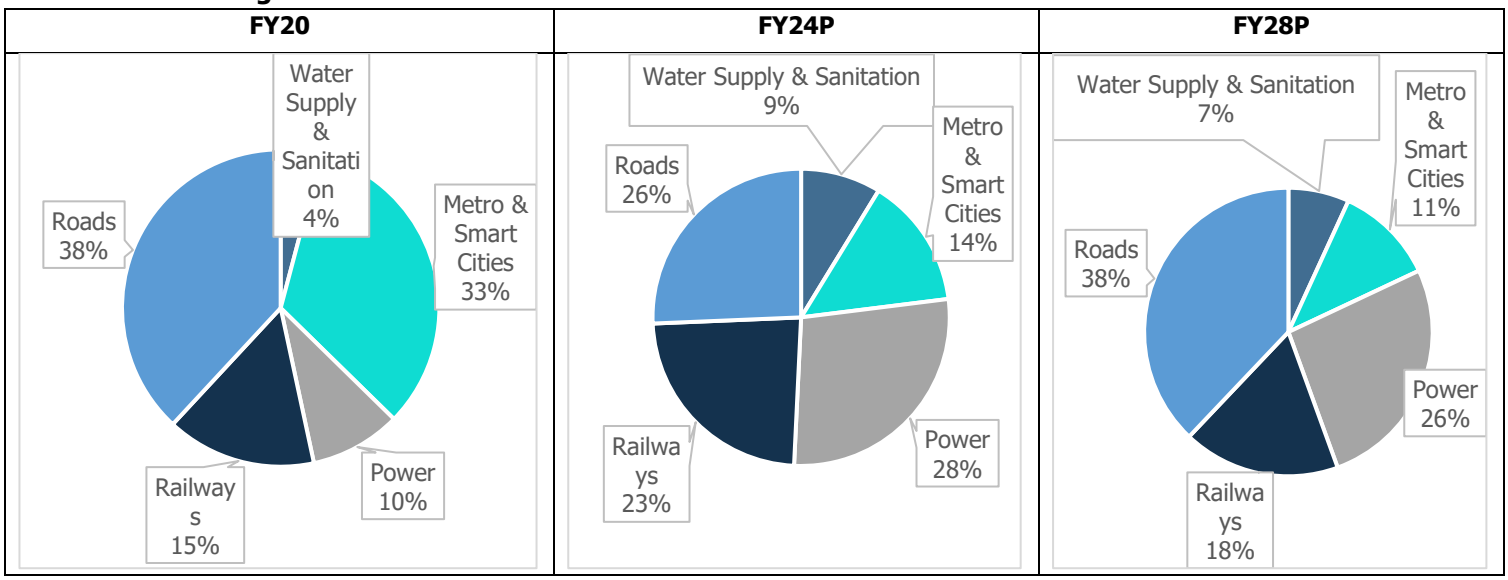


	FY20	FY21	FY22	FY23	FY24P	FY25P	FY26P	FY27P	FY28P
Roads	3,32,600	3,83,300	3,57,000	2,52,800	2,40,800	3,32,700	3,62,600	4,06,100	4,54,800
Railways	1,33,400	2,62,500	3,08,800	2,73,800	2,21,200	1,67,900	1,81,300	1,95,800	2,11,500
Power	81,200	1,22,700	1,64,900	2,03,700	2,60,300	2,74,000	2,87,900	3,02,200	3,17,200
Metro & Smart Cities	2,90,000	4,10,000	3,30,000	1,60,000	1,34,000	1,34,000	1,34,000	1,34,000	1,34,000
Water Supply & Sanitation	36,000	61,000	1,01,000	84,000	82,000	82,000	82,000	82,000	82,000

Source: CareEdge Research, NITI Aayog, NIP

Note: The projections are based on our estimations for multiple sectors which have been derived from respective government department sources.

Chart 15: Percentage allocation sector-wise



Source: CareEdge Research, NITI Aayog, NIP

2.4 Overview of Construction industry in India

2.4.1 Conventional construction method vs PEB construction method

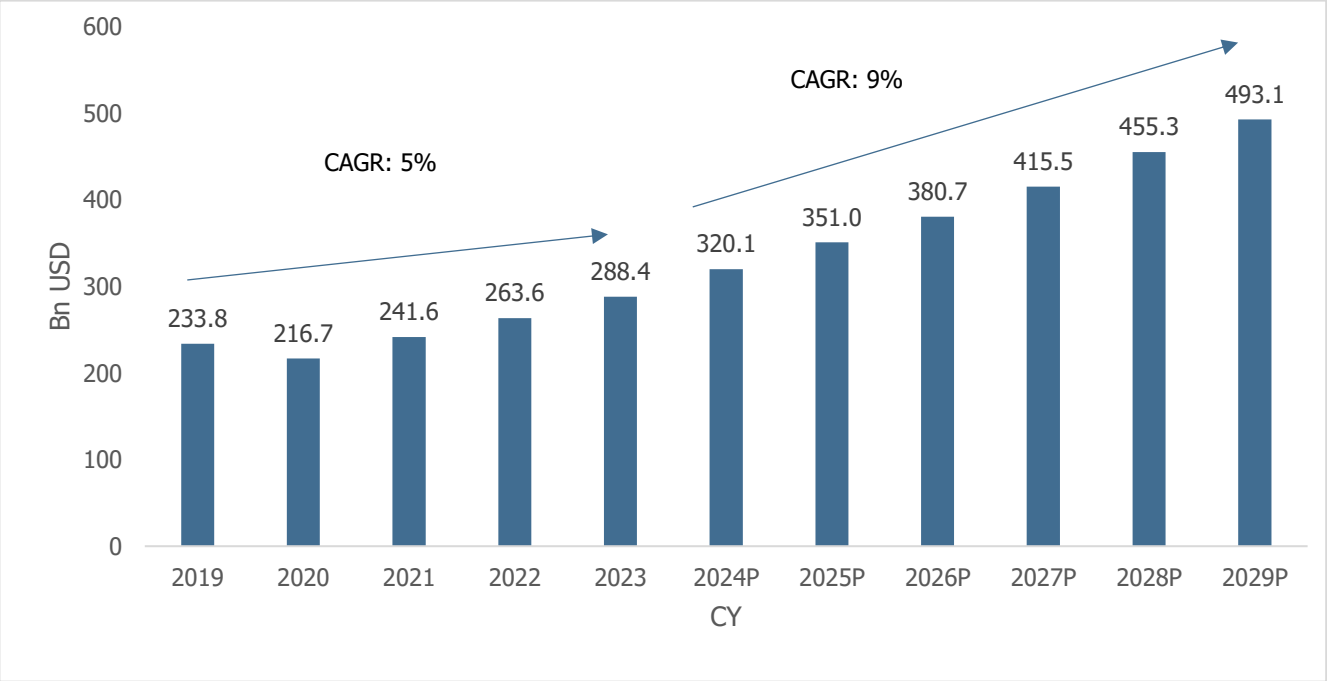
	Pre- Engineered Building Construction	**Conventional Buildings Construction**
Weight	Lighter (20-30%) due to optimized use of steel in built-up sections.	Heavier due to the use of hot-rolled steel sections
Structural Integrity	High, due to factory-controlled quality of components and precise engineering.	Depends on the quality of on-site workmanship and materials.
Customized Design	Limited to pre-designed components but offers flexibility within the system.	Complete design freedom to create unique structures.
Foundation	Requires a simpler and lighter foundation due to the lighter weight of the building.	Needs a more substantial foundation to support the heavier structure.
Erection Process	Faster and easier	Slower and more Labour-intensive
Material Source	The primary material is steel with assorted options for cladding and roofing. Usually, a single material source is responsible.	Several materials, including steel, concrete, wood, and masonry, can be used in conventional construction, usually involving multiple vendors.

Natural Disaster Resistance	Designed to withstand seismic activity with lightweight and flexible components.	Cannot withstand seismic activity but can be made to do so with additional reinforcement.
Suitable For	Warehouses, industrial buildings, retail spaces, large open-span structures.	A wider range of applications, including residential, commercial, institutional, and complex projects.

2.4.2 Market Share in total construction in India

The total construction market in India totalled to USD 288.4 Bn in CY23 growing at a CAGR of 5% from CY19 and is expected to grow at a CAGR of 9% from CY24 to CY29.

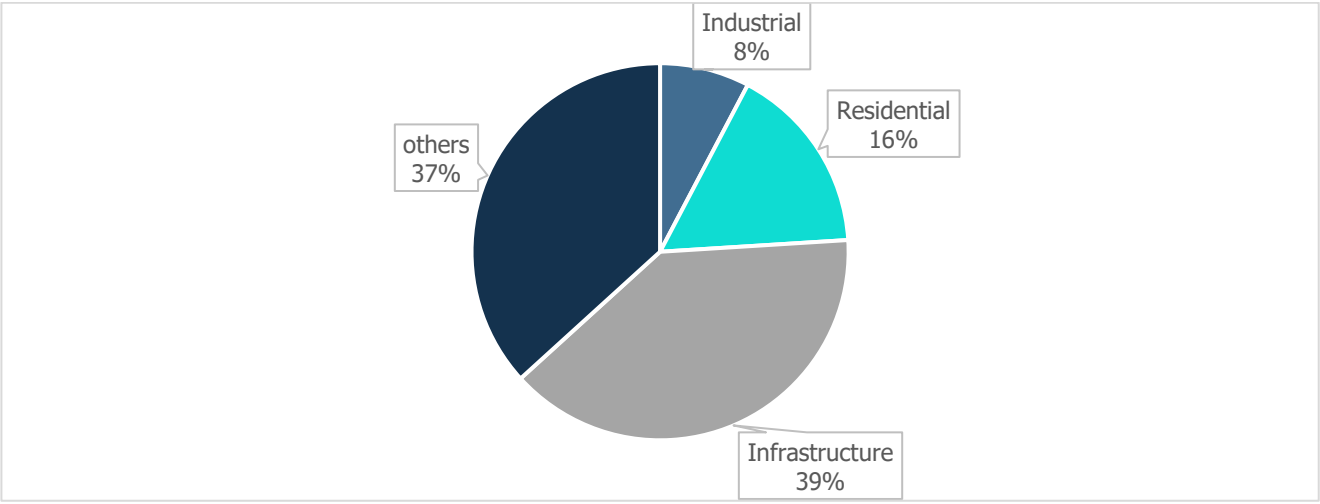
Chart 16: Market Size of Total construction industry in India



Source: Maia Research, CareEdge Research

Infrastructure Sector consists of 39% of the total construction market in CY23 followed by residential and industrial.

Chart 17: Market Share (CY23)



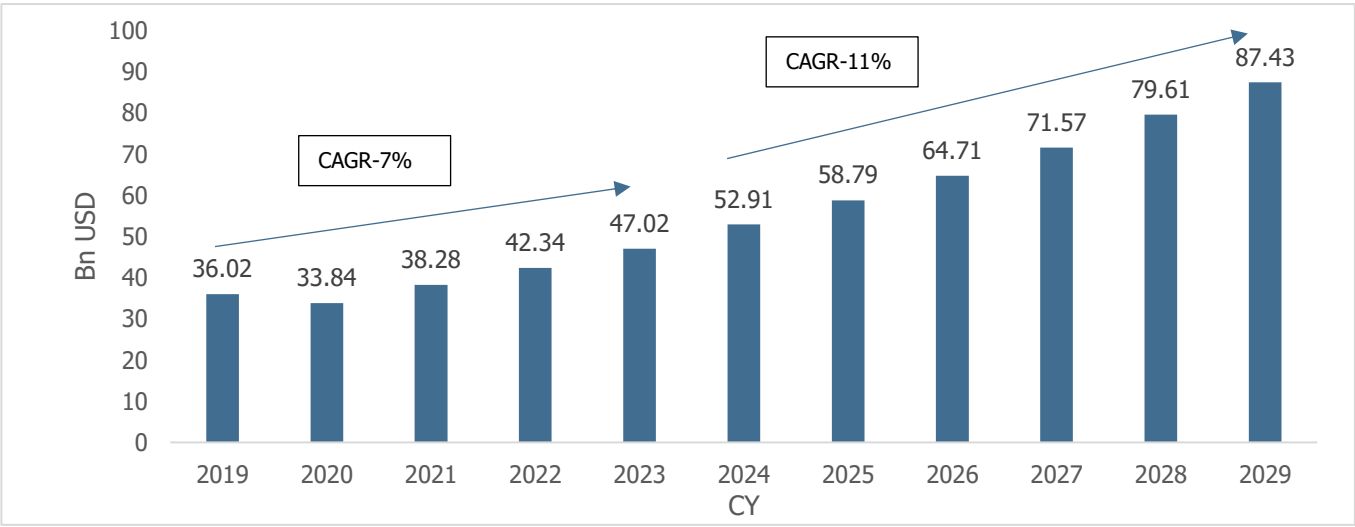
Source: Maia Research, CareEdge Research

Residential

The residential construction market in India is currently experiencing a significant transformation, driven by a combination of factors such as urbanization, government initiatives, and evolving consumer preferences. With the rise of smart cities and infrastructure development, there is an increasing demand for affordable housing, particularly in urban areas. Additionally, sustainable building practices and green construction are gaining traction as awareness of environmental issues grows. Residential construction market size comprises of 15-17% of the total construction market in India between CY19 to CY23 and is expected to continue the same till CY29.

The residential construction market has grown at a CAGR of 7% from CY19 to CY23 and is expected to grow at a CAGR of 11% from CY24 to CY29 due to the expected robust growth with focus on innovation and sustainability.

Chart 18: Market size of the residential construction market



Source: Maia Research, CareEdge Research
Note: CY24 to CY29 are projected numbers

Key growth drivers

1. **Economic Growth and Urbanization**

- Rising household incomes, a growing middle class, and better financial stability are driving investment in residential properties. As urban areas grow, new housing projects are being developed to meet the increasing demand.

2. **Government Initiatives for Housing**

- **PMAY:** The government's affordable housing initiative, now extended beyond 2022, has increased demand, particularly for affordable homes.
- Smart Cities Mission: Focuses on building modern, sustainable cities with residential, commercial, and social amenities.
- **RERA:** The Real Estate Regulation Act has improved transparency, reduced delays, and ensured quality, boosting confidence in the real estate market.

3. **Interest Rates and Financing Options**

- **Low Interest Rates:** The RBI's rate cuts, and favourable lending conditions have made housing loans more affordable, encouraging home purchases.
- **Affordable Housing Loans**: Government schemes like Subvention and tax rebates for first-time buyers enhance housing accessibility.
- **REITs:** The growth of REITs helps developers secure capital more easily, promoting residential development.

4. **Demand for Affordable and Mid-Income Housing**

- **Affordable Housing:** Increasing urban populations, lifestyle changes, and the government's focus on low-income housing are driving demand.
- **Mid-Income Housing:** As disposable incomes rise, the middle class seeks larger, higher-quality homes in suburban areas, boosting development in tier-1 and tier-2 cities.

5. **Infrastructure Development**

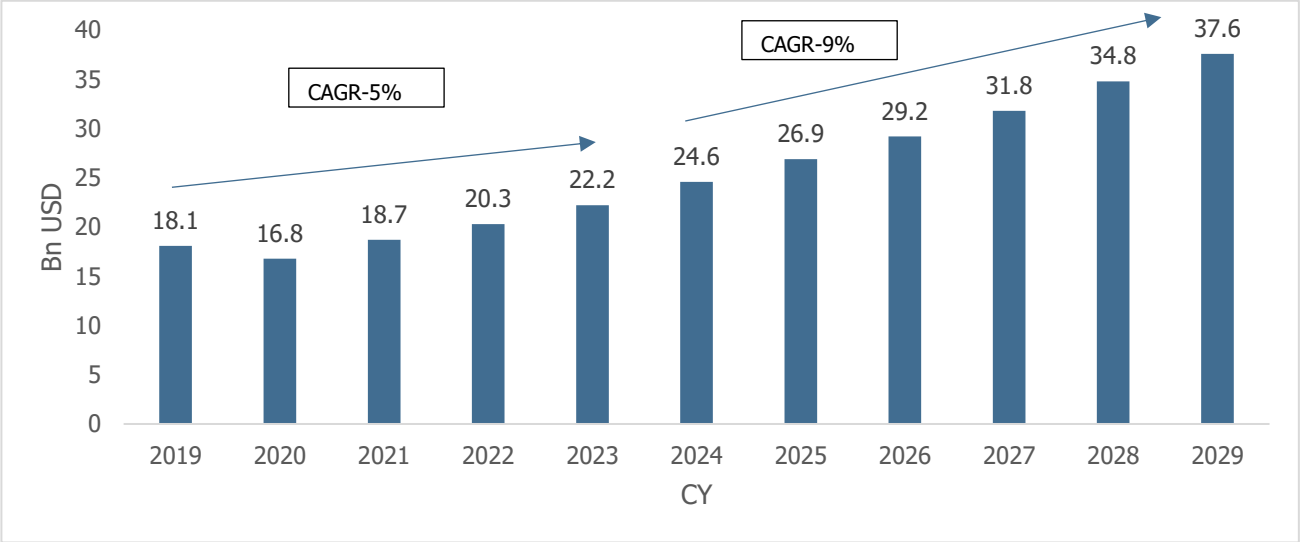
- Improvements in highways, metro networks, and airports have made suburban areas more accessible for residential projects. The rise of integrated townships and mixed-use developments is further fuelling demand for modern residential properties.

Industrial

The industrial construction market in India is witnessing a notable surge, driven by factors such as increased manufacturing demand, government initiatives, and infrastructure development. The "Make in India" campaign has bolstered investments in manufacturing, leading to the establishment of new factories and industrial parks. There is a growing emphasis on logistics and warehousing, fuelled by the rise of e-commerce and a need for efficient supply chain solutions. Sustainability is also becoming a priority, with many projects incorporating eco-friendly materials and energy-efficient designs. Industrial construction market size comprises of 8 to 9% of the total construction market in India between CY19 to CY23 and is expected to continue the same till CY29.

The industrial construction market has grown at a CAGR of 5% from CY19 to CY23 and is expected to grow at a CAGR of 9% from CY24 to CY29 due to the industrial construction sector in India is positioned for substantial growth, reflecting the country’s ambitions to become a global manufacturing hub.

Chart 19: Market size of the industrial construction market



Source: Maia Research, CareEdge Research
Note: CY24 to CY29 are projected numbers

Key growth drivers

1. **Government Initiatives and Policies**
   - **Atmanirbhar Bharat:** The push for self-reliance in industries like manufacturing, electronics, and defence has increased demand for industrial facilities.
   - **Infrastructure Development:** Initiatives like Pradhan Mantri Gati Shakti and the National Infrastructure Pipeline (NIP) have improved transportation and connectivity, boosting demand for industrial facilities.
   - **PLI Scheme:** The Production Linked Incentive scheme encourages manufacturing plants, especially in electronics, auto components, and pharmaceuticals, driving demand for industrial construction.
2. **Rising Demand for Warehousing and Logistics**
   - **E-commerce Growth:** The rapid rise of e-commerce is fuelling the need for warehousing and logistics infrastructure, including storage, fulfilment centres, and distribution hubs.
   - **Industrial and Logistics Parks:** Dedicated industrial and logistics parks are driving demand for warehouses, factories, and distribution centres.
   - **Cold Storage Demand:** The agricultural and food processing sectors' growth is increasing the demand for cold storage and refrigerated warehousing.
3. **Rising Demand for Sustainable and Green Buildings**
   - **Green Building Trends:** Growing environmental awareness is increasing demand for green and LEED-certified industrial spaces.
   - **Government Incentives:** Government incentives for energy-efficient and sustainable construction are encouraging eco-friendly industrial development.
4. **Growing Demand from Key Sectors**
   - **Manufacturing and Heavy Industry:** Growth in sectors like automobile manufacturing, pharmaceuticals, electronics, and steel is driving the need for new industrial facilities.
   - **Energy Sector Growth:** The expansion of renewable energy infrastructure, such as solar and wind farms, is increasing demand for industrial construction.
   - **Pharmaceuticals and Biotechnology:** The growth of pharmaceutical and biotechnology sectors, driven by global healthcare needs, is fuelling the construction of specialized industrial spaces.

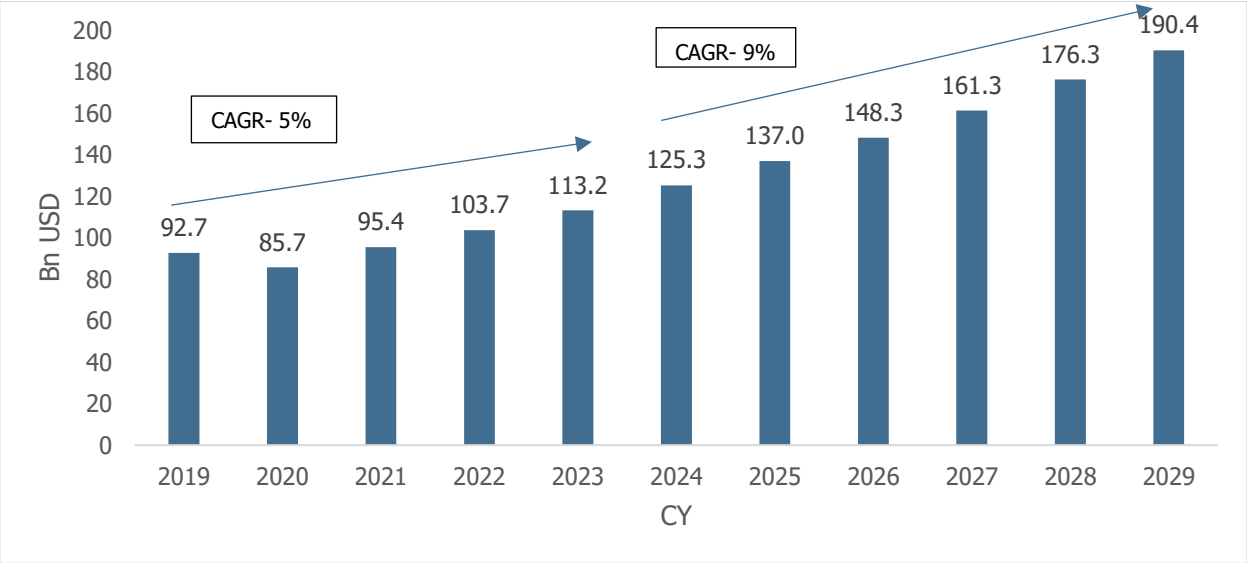
5. **Availability of Land and SEZs**
    - **SEZs**: The establishment of Special Economic Zones (SEZs) has simplified land acquisition, offering tax incentives and infrastructure support for industrial projects.
    - **Dedicated Industrial Parks:** Industrial parks with ready-to-build infrastructure are stimulating the construction of industrial facilities.

Infrastructure

The infrastructure construction market in India is currently experiencing robust growth, propelled by significant government investment and a focus on enhancing connectivity and urban development. Key initiatives such as the National Infrastructure Pipeline (NIP) aim to mobilize investment across sectors, including transportation, energy, and urban infrastructure. Infrastructure construction market size comprises of about 40% of the total construction market in India between CY19 to CY23 and is expected to continue the same till CY29.

The industrial construction market has grown at a CAGR of 5% from CY19 to CY23 and is expected to grow at a CAGR of 9% from CY24 to CY29 due to the expected significant expansion, reflecting the country's ambitions for comprehensive and sustainable growth.

Chart 20: Market size of the infrastructure construction market



Source: Maia Research, CareEdge Research; Note: CY24 to CY29 are projected numbers

Key Growth Driver

1. **1. Government Initiatives and Policies**

- **National Infrastructure Pipeline (NIP)**: The government's ₹111 trillion investment in infrastructure, covering sectors like transportation, energy, and urban development, is expected to boost the construction sector.
- **Smart Cities Mission**: This initiative focuses on developing smart cities to tackle urbanization, driving demand for residential, commercial, and civic infrastructure.

2. **Private Sector Investment**

- Increased private sector involvement, through Public-Private Partnerships (PPP), is funding large projects in airports, roads, highways, and smart cities, with multinational companies also contributing to growth in India's infrastructure sector.

3. **Industrial Growth and Manufacturing Expansion**

- India's rise as a global manufacturing hub, particularly through the Make in India initiative, is driving demand for industrial parks, logistics hubs, and transportation networks, stimulating construction growth.

4. **Transportation and Connectivity Development**

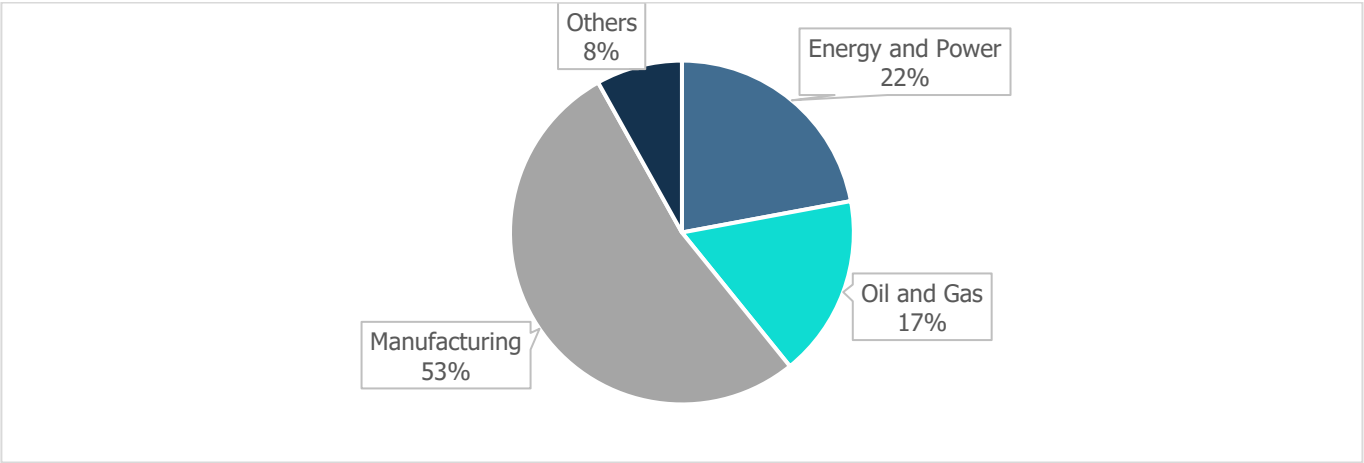
- The government's focus on enhancing transportation infrastructure, including roads, railways, airports, and ports, is fuelling demand for construction services. Projects like Dedicated Freight Corridors, Expressways, Metro Rails, and International Airports are key drivers of sector expansion.

5. **Focus on Sustainability and Green Infrastructure**

- The growing focus on sustainable construction practices, such as green buildings and renewable energy use, is increasing demand for energy-efficient, eco-friendly infrastructure, in line with India's climate goals.

2.4.3 End User market Share of Industrial construction investment in India

Chart 21: End User market Share of Industrial construction investment in India (CY23)

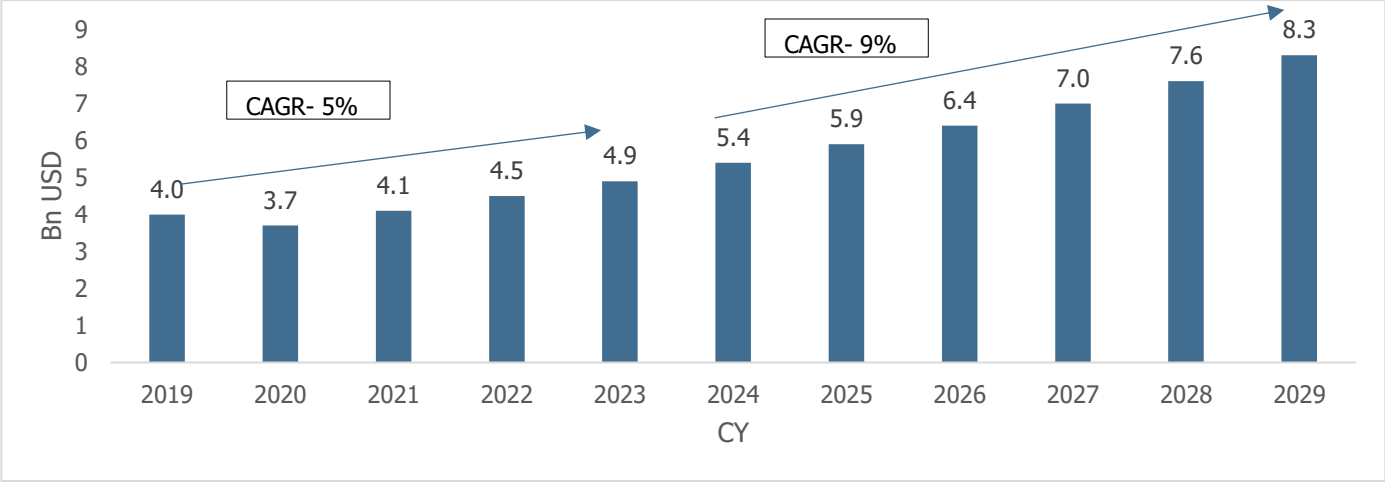


Source: Maia Research, CareEdge Research

Energy and Power

India's energy and power sector are undergoing a transformation, driven by the demand for sustainable and reliable energy. As the country focuses on reducing its carbon footprint, there is a shift towards renewable energy, particularly solar and wind power. The government's renewable energy targets have led to investments in solar farms, wind parks, and energy-efficient facilities. The rise of electric vehicles is also driving the development of charging infrastructure. Additionally, industrial facilities are adopting smart technologies to improve energy efficiency. The energy and power construction market grew at a CAGR of 5% from CY19 to CY23 and is expected to grow at 9% CAGR from CY24 to CY29, reaching USD 8.3 Bn.

Chart 22: Market size of the Energy and Power construction market

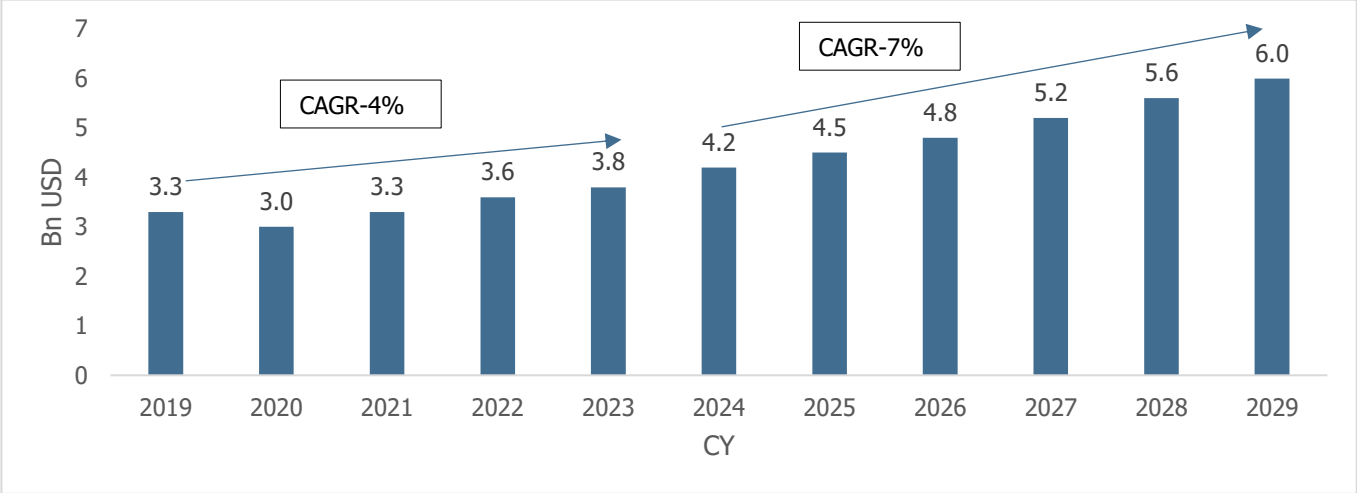


Source: Maia Research, CareEdge Research
Note: CY24 to CY29 are projected numbers

Oil and Gas

India's oil and gas sector are evolving, driven by both domestic and international factors. To enhance energy security, the country is expanding refining capacity, developing strategic reserves, and upgrading existing infrastructure. Major projects include new refineries and petrochemical complexes, supported by government initiatives for greater energy self-sufficiency. The push for cleaner fuels is also fuelling investments in biofuels, natural gas, LNG terminals, and pipeline networks. The oil and gas construction market grew at a CAGR of 4% from CY19 to CY23 and is expected to grow at 7% CAGR from CY24 to CY29, reaching USD 6 Bn.

Chart 23: Market size of the Oil and Gas construction market

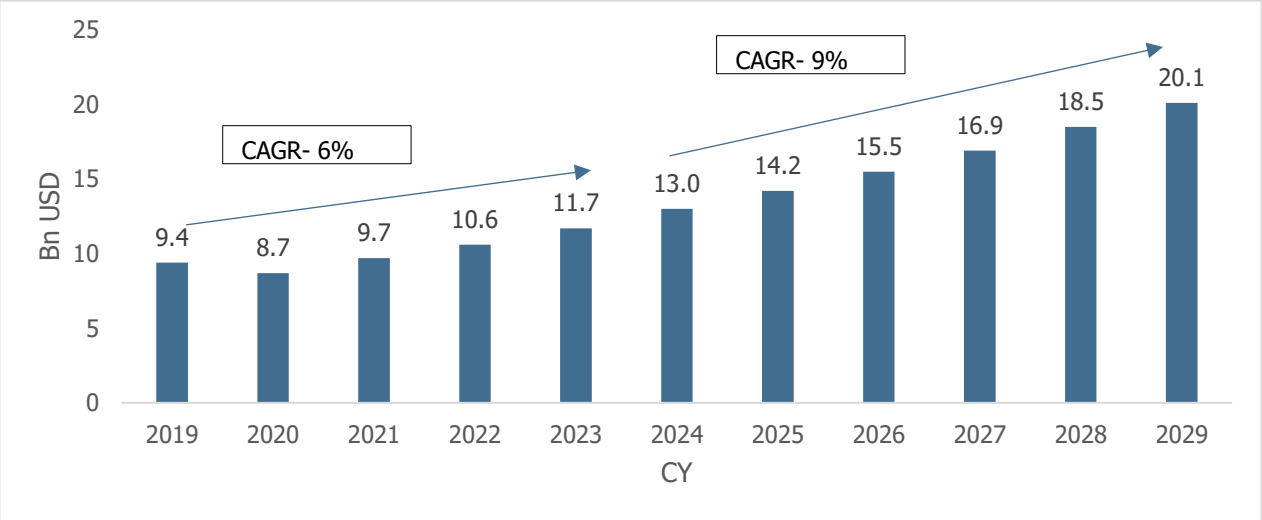


Source: Maia Research, CareEdge Research
Note: CY24 to CY29 are projected numbers

Manufacturing

The current trend in manufacturing within India's industrial construction market is characterized by a significant shift towards automation and digitalization. This evolution is further fuelled by government initiatives aimed at boosting infrastructure development and attracting foreign investment, making India a competitive hub for industrial construction. Overall, the focus on innovation, sustainability, and smart manufacturing processes is reshaping the landscape of the sector. The manufacturing construction market has grown at a CAGR of 6% from CY19 to CY23 and is expected to grow at a CAGR of 9% from CY24 to CY29 to reach USD 20.1 Bn.

Chart 24: Market size of the Manufacturing construction market



Source: Maia Research, CareEdge Research
Note: CY24 to CY29 are projected numbers

2.4.5 Key Growth Drivers for Construction industry in India

The construction industry in India is experiencing robust growth driven by several key factors:

Growth Drivers	Description
Government Initiatives and Funding	The Indian government has launched ambitious programs such as the National Infrastructure Pipeline (NIP), which aims to invest approximately Rs 111 trillion (around USD 1.5 trillion) in infrastructure projects by 2025. Initiatives like "Housing for All" and smart city projects are expected to significantly boost construction activity, with estimated investments in urban infrastructure and housing reaching Rs 25 trillion (approximately USD 335 billion) over the next few years.
Urbanization	India is witnessing rapid urbanization, with projections indicating that by CY31, about 600 million people will reside in urban areas. The urban construction sector is expected to grow at a CAGR of around 6-8% from CY21 to CY26, highlighting the need for comprehensive urban planning and infrastructure development.

Growth Drivers	Description
Foreign Direct Investment (FDI)	The construction sector has become increasingly attractive to foreign investors, with FDI inflows in construction activities reaching approximately USD 34 billion from FY14 to FY24.
Technological Advancements	The adoption of modern construction technologies, such as Building Information Modelling (BIM), prefabrication, and automation, is transforming the construction landscape. The market for construction technology in India is projected to grow at a CAGR of around 20% over the next five years, indicating a shift towards more efficient construction practices.
Sustainability and Green Building	There is an increasing emphasis on sustainable construction practices, driven by both regulatory requirements and consumer demand. The use of eco-friendly materials and energy-efficient designs not only meets environmental standards but also attracts investment.

2.4.6 Government Regulation and Policies impacting the construction sector in India

Some of the key government construction schemes include:

The 2023-24 budget by the government highlights the impetus for growth by focusing on big public investment for modern infrastructure, which will be guided by PM Gati Shakti and benefit from the synergy of a multi-modal approach. 100 critical transport infrastructure projects have been identified at an investment of Rs 750 Billion including Rs 150 Billion from private players. For the urban infrastructure in Tier–II and Tier–III cities, a corpus of Rs 100 Billion has been set aside via the establishment of the Urban Infrastructure Development Fund.

- Smart Cities Mission: This mission focuses on 100 smart cities implementing projects in areas like mobility, energy, water, sanitation, waste management, public spaces, social infrastructure, and governance. As of September 2023, over 6,000 projects worth more than ₹1.1 trillion have been completed, with remaining projects set to finish by June 30, 2024.
- AMRUT: Launched in June 2015 for 500 cities, AMRUT aims to improve urban infrastructure. It was expanded to AMRUT 2.0 in October 2021, covering the period from FY 2021-22 to FY 2025-26. The mission focuses on providing universal water supply and sewerage management in the cities covered in the first phase.
- PMAY: The Pradhan Mantri Awas Yojana (PMAY) emphasizes affordable housing for all, with steady budget allocations. The government's efforts in sanctioning and completing numerous houses under both PMAY-Urban and PMAY-Gramin highlight its commitment to improving living conditions across the country.

The table below shows the budgetary allocation trend:

Table 4: Scheme-Wise Allocation Towards Infrastructure in FY24 (Rs Million)

Description	FY22	FY23	FY24	FY 25[BE]
Pradhan Mantri Awas Yojna (PMAY)	9,00,000	7,71,000	7,96,000	8,07,000
Urban Rejuvenation Mission: AMRUT and Smart Cities	1,39,000	1,53,000	1,60,000	1,04,000

Source: Union Budget 2023-24 Analysis

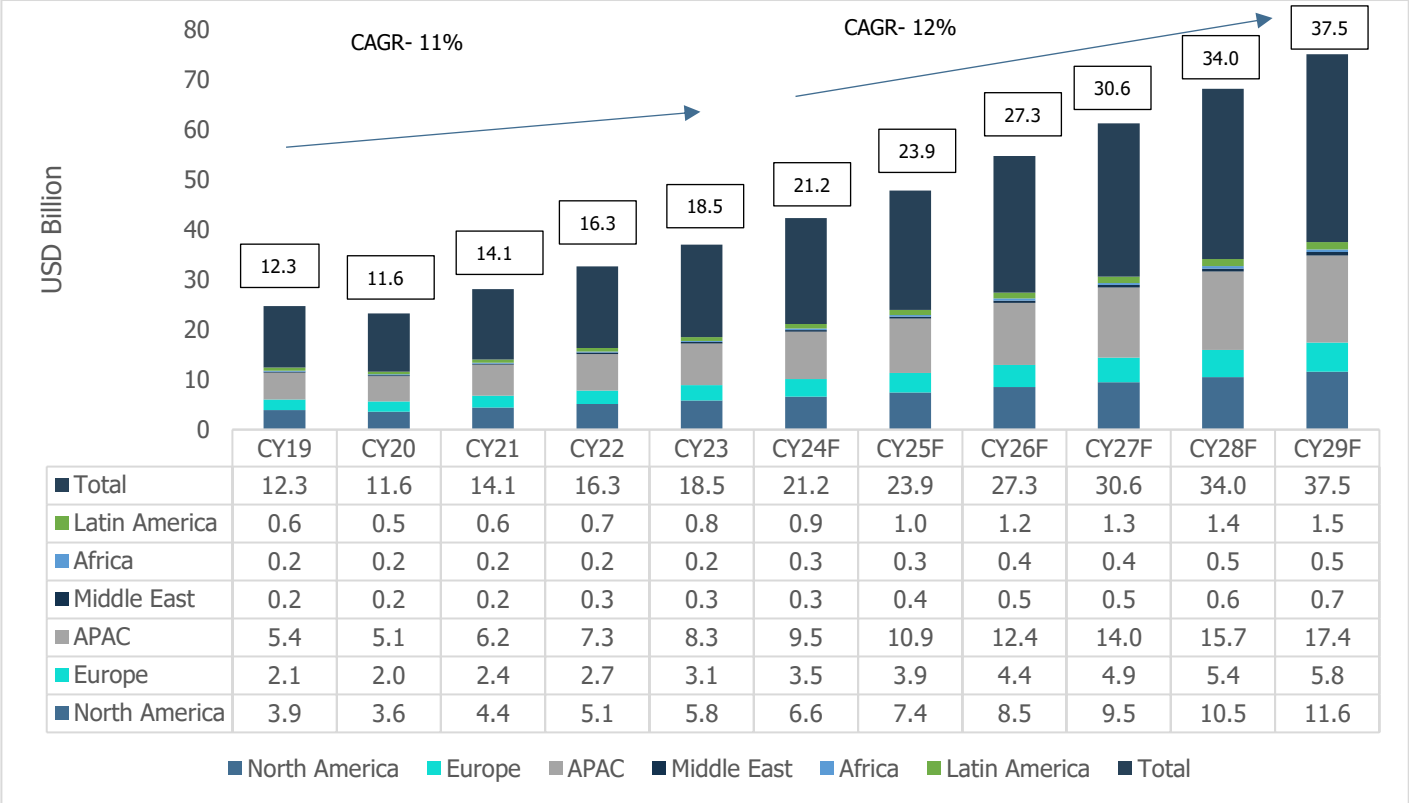
3. Overview of type of construction activity in India

3.1 Overview of Global PEB Market

The global Pre-Engineered Buildings (PEB) market is witnessing significant growth due to increasing demand for cost-effective, time-efficient, and sustainable construction solutions across various industries. PEBs are custom-designed, factory-built structures made of steel or other materials that are prefabricated and pre-engineered to meet specific requirements. Additionally, the rising demand for green buildings and energy-efficient solutions is encouraging the use of PEBs, as they offer lower environmental impact and reduced energy consumption. North America, Europe, and Asia-Pacific are the major regions contributing to the growth of the PEB market, with India, China, and the United States leading in construction activities. As industries continue to prioritize sustainability and cost-effective solutions, the global PEB market is expected to experience steady growth in the coming years.

The global PEB market in grew at a CAGR of 11% from CY19 to CY24 and is expected to grow at a CAGR of 12% from CY24 to CY29 to reach USD 37.5 Bn.

Chart 25: Global PEB Market Size



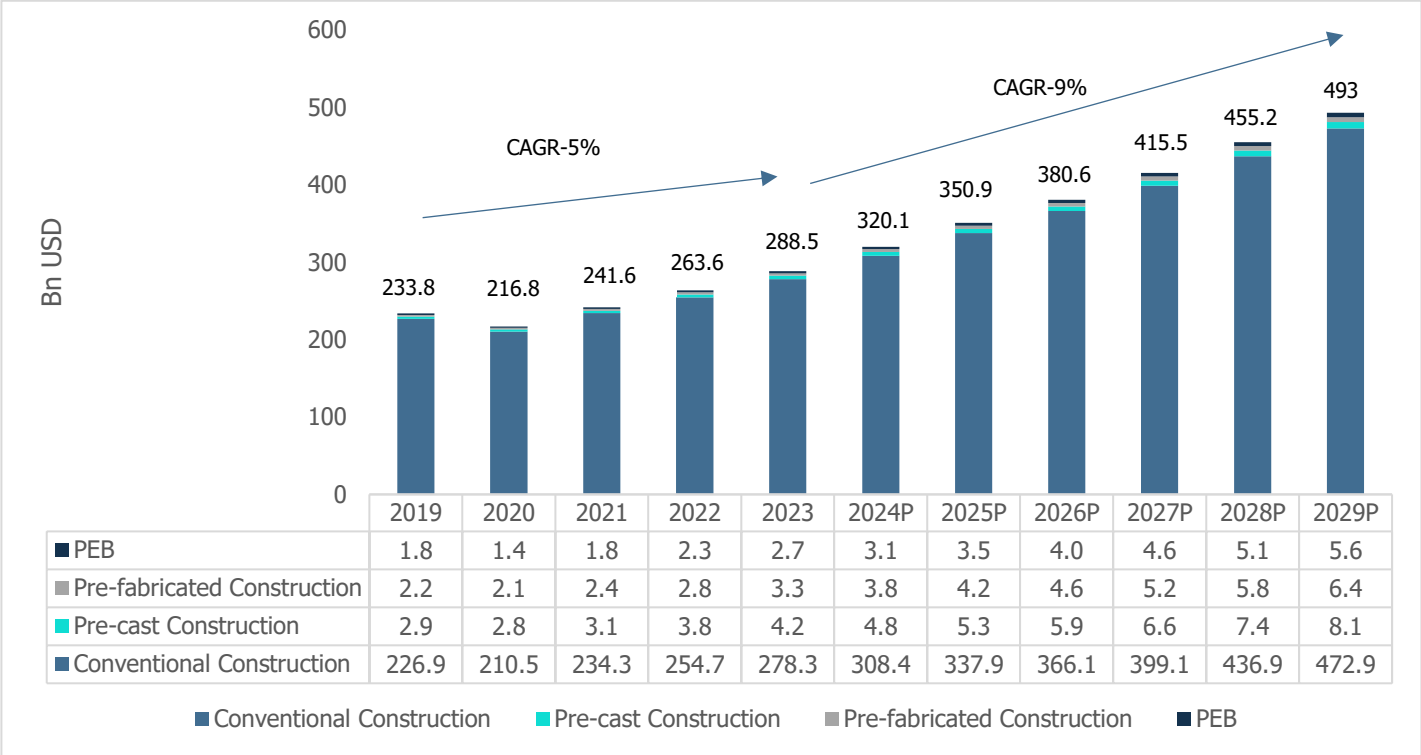
	CY19	CY20	CY21	CY22	CY23	CY24F	CY25F	CY26F	CY27F	CY28F	CY29F
Total	12.3	11.6	14.1	16.3	18.5	21.2	23.9	27.3	30.6	34.0	37.5
Latin America	0.6	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.5
Africa	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5
Middle East	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.7
APAC	5.4	5.1	6.2	7.3	8.3	9.5	10.9	12.4	14.0	15.7	17.4
Europe	2.1	2.0	2.4	2.7	3.1	3.5	3.9	4.4	4.9	5.4	5.8
North America	3.9	3.6	4.4	5.1	5.8	6.6	7.4	8.5	9.5	10.5	11.6

Source: Maia Research, CareEdge Research

3.2 Market Size of Total Construction Market in India

The construction industry can be divided into conventional, Pre- Cast, Pre- Fabricated and Pre- Engineered Building construction methods. The total construction market has grown at a CAGR of 5% from CY19 to CY23 and is expected to grow at a CAGR of 9% from CY23 to CY29 to reach USD 493.1 Billion.

Chart 26: Market Size of Construction Market in India



	2019	2020	2021	2022	2023	2024P	2025P	2026P	2027P	2028P	2029P
PEB	1.8	1.4	1.8	2.3	2.7	3.1	3.5	4.0	4.6	5.1	5.6
Pre-fabricated Construction	2.2	2.1	2.4	2.8	3.3	3.8	4.2	4.6	5.2	5.8	6.4
Pre-cast Construction	2.9	2.8	3.1	3.8	4.2	4.8	5.3	5.9	6.6	7.4	8.1
Conventional Construction	226.9	210.5	234.3	254.7	278.3	308.4	337.9	366.1	399.1	436.9	472.9

Source: Maia Research, CareEdge Research

Pre-Cast Construction

Precast construction involves casting concrete into reusable moulds, curing it in a controlled environment, and then transporting the components to the construction site. This method offers advantages over traditional cast-in-place concrete, such as better-quality control, faster construction, and reduced labour costs.

The precast construction market in India has grown significantly, driven by technological advancements, a shift toward faster building methods, and government initiatives for affordable housing and infrastructure development. The market grew at a CAGR of 10% from CY19 to CY23 and is expected to grow at 11% CAGR from CY24 to CY29, reaching USD 8.1 Bn.

Prefabricated Construction

The prefabricated construction market in India has witnessed significant growth from 2019 to 2023, driven by rising demand for faster, cost-effective, and sustainable building solutions. Over this period, factors such as rapid urbanization, increasing infrastructure development, government initiatives, and a growing focus on smart cities have fuelled the adoption of prefabricated construction methods.

Looking ahead, the prefabricated construction market in India is expected to continue its upward trajectory. The government's focus on "Housing for All" and sustainable infrastructure, combined with growing private sector investment, will likely spur further innovation and adoption. Additionally, as environmental concerns grow, the emphasis on green building materials and energy-efficient construction will further push the demand for prefabricated solutions.

The pre-fabricated construction market in India grew at a CAGR of 11% from CY19 to CY23 and is expected to grow at a CAGR of 11% from CY24 to CY29 to reach USD 6.4 Bn.

3.3 Overview of PEB Market in India

The Pre-Engineered Building (PEB) market in India has witnessed significant growth across multiple sectors due to its advantages in terms of cost-effectiveness, construction speed, and flexibility. PEBs, primarily constructed using steel and other durable materials, are designed, and fabricated in a factory and assembled on-site, making them ideal for industrial, commercial, and infrastructure applications.

Manufacturing and Industrial Sector: The manufacturing and industrial sectors are among the largest adopters of PEBs in India. These buildings are ideal for factories, production units, assembly plants, and warehouses due to their scalability and ease of expansion. The rapid industrialization driven by government initiatives like *Make in India* and *Atmanirbhar Bharat* has further bolstered the demand for PEBs.

Warehousing and Logistics: The warehousing and logistics sector has seen a significant shift towards PEBs due to the booming e-commerce and retail sectors in India. As the need for large, cost-effective storage spaces increases, PEBs provide an efficient solution. The government's push to develop logistics hubs under the *National Logistics Policy* further promotes the use of PEBs in this sector.

Retail and Commercial Sector: PEBs are increasingly being used for retail outlets, shopping malls, showrooms, and commercial complexes due to their versatility in design and the ability to meet high-performance standards. Additionally, PEBs offer flexibility in terms of expansion and redesign, making them attractive for growing retail chains and businesses.

Infrastructure and Public Sector Projects: The infrastructure sector, including projects related to transportation (airports, bus terminals, railway stations), sports facilities, and public buildings, is another significant area where PEBs are gaining traction. Their quick construction timelines and ability to withstand harsh weather conditions make them a preferred choice for infrastructure projects, especially in regions with time-sensitive requirements.

Agriculture and Agro-Processing: The agricultural sector, including agro-processing units and cold storage facilities, is another area where PEBs are becoming popular. These buildings offer a durable, cost-effective solution for housing agricultural equipment, processing plants, and storage units. The growing emphasis on food processing and agricultural exports in India is driving demand for PEBs in this sector.

Healthcare and Education: With the rapid expansion of healthcare and educational institutions in both urban and rural areas, PEBs are being utilized for constructing hospitals, clinics, schools, and universities. Their ability to provide quick, scalable solutions is vital in addressing the infrastructure gap in these sectors. Furthermore, the flexibility and customization offered by PEBs allow for meeting specific requirements such as patient care facilities, Laboratories, and classrooms.

Because of the above factors, the PEB market in India is poised for continued growth as industries across various sectors recognize the benefits of using pre-engineered buildings for their cost-efficiency, faster construction times, and flexibility. It has grown at a CAGR of 11% from CY19 to CY23 and is expected to grow at a CAGR of 13% from CY24 to CY29 to reach USD 5.6 Billion.

3.4 ESG Strategies and Trends in Steel Industry

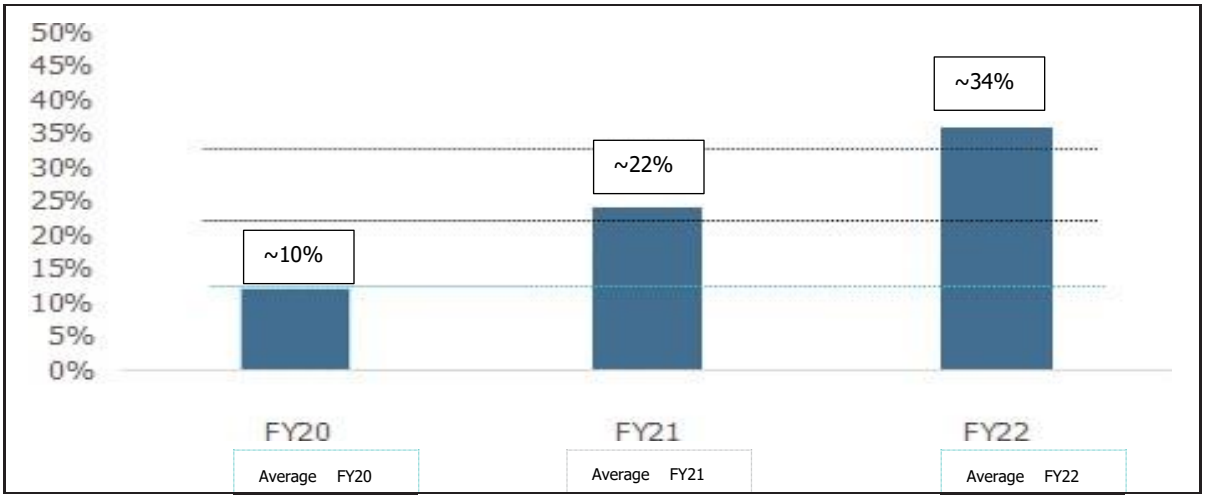
The steel industry has significantly shifted its ESG practices, focusing on reducing carbon emissions and energy consumption. Manufacturers are improving energy efficiency, optimising waste and water management, and incorporating renewable energy sources. Innovations like hydrogen-based reduction and carbon capture technologies are further reducing the carbon footprint.

Globally, the steel sector faces growing pressure to enhance sustainability, as it accounts for 7% of global CO2 emissions. To meet the Paris Agreement's goal of a 50% emission reduction by 2050, the industry is adopting energy-efficient technologies, alternative fuels, and renewable resources.

The European Parliament and EU Council have reached a historic agreement on a carbon Border Adjustment Mechanism (CBAM) that will apply to the import of certain product groups to the EU starting October 1, 2023. The Carbon Border Adjustment Mechanism (CBAM) is a carbon pricing mechanism proposed by the European Union (EU) to put a price on carbon emissions from imported goods. Under the CBAM, importers of goods from outside the EU will need to purchase certificates for the carbon emissions associated with those goods. CBAM is one of the elements of the EU Green Deal, the goal of which is to reduce GHG emissions by 55% by 2030. CBAM is aimed at equalizing the price of carbon paid for EU products operating under the EU Emissions Trading System (ETS) and imported goods. The CBAM will be implemented in two phases: A transitional phase, which will begin in 2023 and run until 2026. During this phase, the CBAM will be based on a simplified emissions calculation methodology. A full phase, which will begin in 2026. During this phase, the CBAM will be based on a more comprehensive emissions calculation methodology. The Carbon Border Adjustment Mechanism (CBAM) is expected to affect a sizeable portion of India's annual steel exports to Europe, with estimates suggesting that it could impact anywhere between 15% to 40% of the exports.

The steel industry in India is adapting to the evolving ESG landscape to demonstrate its commitment to sustainable and responsible practices. By integrating ESG considerations into their operations, steel companies aim to enhance their competitiveness, attract investments, meet regulatory requirements, and fulfil the expectations of various stakeholders.

Chart 27: Percentage of companies in the steel sector with ESG disclosures



Source: CareEdge Advisory

4. Overview of manufacturing sector in India

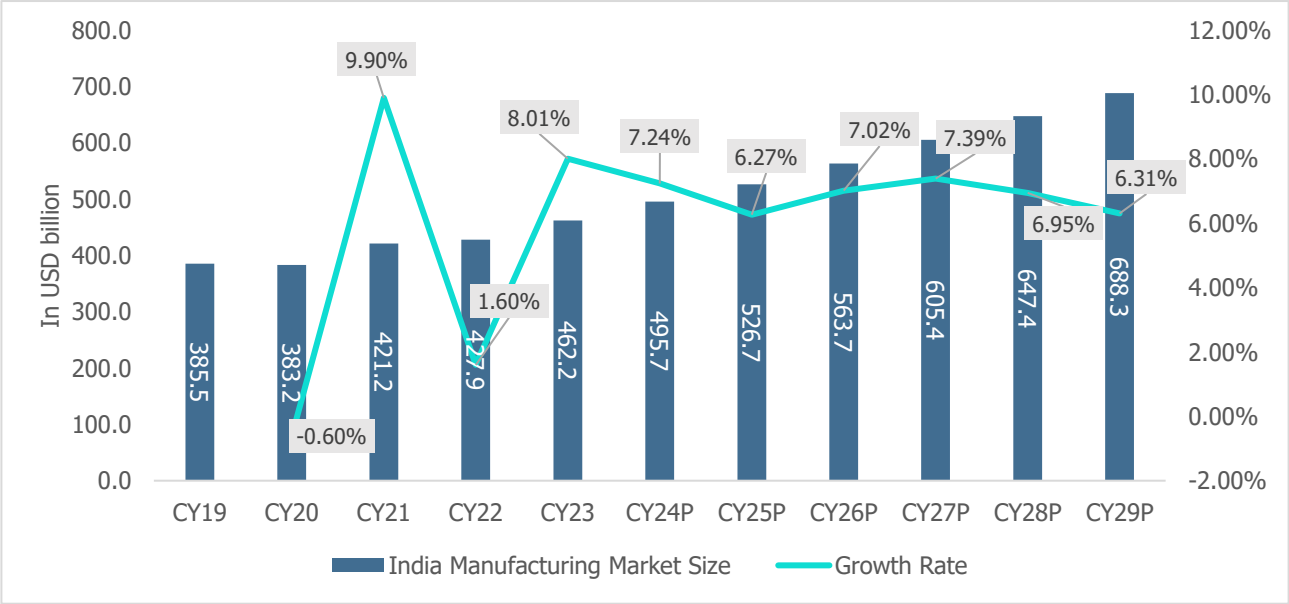
India's manufacturing industry is a crucial element in the country's economic growth, serving as a key factor in the government's ambition to elevate the nation to a $5 trillion economy. The manufacturing industry plays a vital role in advancing GDP expansion, enhancing exports, generating job openings, and constructing essential infrastructure

The Make in India initiative has played a key role in transforming India's manufacturing sector over the past ten years by attracting investments, updating infrastructure, and enhancing the business environment. Initiatives like FDI reforms, GST, and the PLI scheme have improved the sector's competitiveness on a global scale. Despite obstacles, the manufacturing industry continues to show strength and promise for growth, emphasizing the importance of innovation, technology integration, and skills enhancement.

India's future economic growth is heavily supported by the sector's continuous success, thanks to ongoing reforms and the country's strategic partnerships with global players. With the aim of achieving a 25% share of GDP by 2025, the manufacturing sector in India is expected to have a greater impact on the country's economy

4.1 Trend of manufacturing sector in India and outlook

Chart 28: Manufacturing sector in India



Source: Maia Research, CareEdge Research

The trend in India's manufacturing market size from CY19 to CY29P shows fluctuating trend, with a slight contraction in CY20 due to the pandemic (-0.6%), followed by strong recovery in CY21 (+9.9%) and steady growth in subsequent years. The market grows at a healthy pace, averaging around 6-8% annually, driven by ongoing reforms, increasing investment, and expansion in key sectors like electronics, pharmaceuticals, and automotive. The growth rate remains steady after CY25 but remains positive, reflecting a mature and evolving manufacturing landscape.

4.2 Sub sector split and manufacturing clusters in India

Table 5: IIP-Manufacturing split in engineered products (in % y-o-y change)

Type of product	FY20	FY21	FY22	FY23	FY24
Manufacture of electrical equipment	-4.5	-12.3	12.2	-4.2	7.5
Manufacture of machinery and equipment n.e.c.	-12.7	-14.1	11.0	10.5	6.6
Manufacture of motor vehicles, trailers, and semi-trailers	-18.3	-19.1	18.4	19.3	11.6
Manufacture of other transport equipment	-6.2	-18.0	1.6	11.6	13.9
Manufacture of other non-metallic mineral products	-1.9	-12.9	20.1	6.6	6.5
Manufacture of basic metals	11.0	-5.8	18.6	8.1	11.6
Manufacture of fabricated metal products, except machinery and equipment	-14.7	-13.7	10.9	-1.6	8.3
Others	-3.3	-16.4	14.7	2.6	-2.2

Source: MOSPI

The manufacturing trends in engineered products from FY20 to FY24 show varied performance across different sectors. The manufacture of motor vehicles, trailers, and semi-trailers saw significant declines in FY20 and FY21, with decreases of 18.3% and 19.1%, respectively. This was followed by a rebound with growth in FY22 18.4%, FY23 19.3%, and a slower increase in FY24 11.6%. Similarly, the manufacture of machinery and equipment experienced declines in the early years, with reductions of 12.7% in FY20 and 14.1% in FY21, before recovering in FY22 11.0% and FY23 10.5%, and showing moderate growth in FY24 6.6%. The manufacture of electrical equipment and other transport equipment also had negative growth in FY20 and FY21, with reductions of 4.5% and 6.2%, 12.3% and 18.0%, respectively. Electrical equipment sector continued with negative performance and other transport equipment showed recovery in FY23, with y-o-y percentage changes of -4.2% and 11.6%, and both sectors showed positive performance in FY24 with 7.5% and 13.9%.

In contrast, the manufacture of basic metals showed more consistent growth, with rates of 11.0% in FY20, 18.6% in FY22, 8.1% in FY23, and 11.6% in FY24. The manufacture of fabricated metal products experienced declines in FY20 and FY21, with reductions of 14.7% and 13.7%, but recovered in FY22 with growth of 10.9%, followed by more modest growth in FY24 8.3%. The manufacture of non-metallic mineral products saw fluctuations, with a significant increase of 20.1% in FY22, followed by more moderate growth in FY23 6.6% and FY24 6.5%. Overall, while many sectors show signs of recovery after the downturns in FY20 and FY21, the growth patterns differ across industries, reflecting varied sector-specific dynamics.

4.3 Growth drivers in the manufacturing sector

Growth Drivers	Description
Technological Advancements in Manufacturing	One of the key drivers of growth in the PEB sector is the continuous advancement in manufacturing technologies. The innovations allow for faster assembly and better customization, making PEB an increasingly attractive option for both residential and commercial buildings.
Cost Efficiency and Sustainability	Pre-engineered construction is gaining popularity due to its cost-efficiency and sustainability benefits. The use of standardized components and off-site manufacturing reduces labour costs and minimizes construction time, making PEB an appealing option for cost-conscious

Growth Drivers	Description
	clients. Additionally, PEB involves less material wastage and allows for the use of eco-friendly materials, contributing to sustainability.
Growing Infrastructure and Urbanization	As global urbanization continues to rise, there is an increasing demand for faster, more efficient construction methods to meet the needs of expanding infrastructure. PEB provides a solution for quickly developing urban spaces such as warehouses, factories, schools, and commercial buildings
Government Support and Regulations	Government policies and incentives aimed at boosting industrial growth and sustainable construction practices play a significant role in the growth of PEB. Various governments are offering subsidies, tax breaks, and regulations that encourage the use of prefabricated building methods for both residential and commercial projects.
Ease of Doing Business Reforms	The Indian government has implemented a series of reforms to improve the ease of doing business in the country. Key measures include the Goods and Services Tax (GST), which simplifies the taxation system, and the Labour Codes, which consolidate multiple Labour laws into a simpler framework to reduce compliance burdens for businesses.

4.4 Government policies and regulations

Some of the key government policies and regulations:

- **Production Linked Incentive (PLI) Scheme**

Launched in March 2020, the PLI scheme aims to enhance domestic manufacturing capabilities, increase import substitution, and generate employment. It seeks to attract investments, boost production, and make Indian manufacturers globally competitive.

- **PLI Scheme for Specialty Steel-**
  - The objective of PLI scheme for 'specialty steel' is to promote manufacturing of specialty steel grades within the country by providing financial incentives.
  - The release of incentive will be from FY 2024-25 to 2030-31-

Financial Year	Outlay (Rs. Cr.)
FY25	775
FY26	1,088
FY27	1,394
FY28	1,377
FY29	1,293
FY30	222
FY31	173
Total	**6,322**

- **Make in India**

The Make in India initiative, launched in 2014, focuses to position India as a global manufacturing and entrepreneurial hub, transforming the business environment across various sectors. Its goal is to enhance the country's industrial capabilities and foster a culture of innovation and investment.

The initiative has identified 25 key sectors for development, including manufacturing, infrastructure, and services. Foreign Direct Investment (FDI) has been significantly opened in areas like Defence Production, Construction, and Railway infrastructure, reflecting a strategic effort to boost industrial growth and attract global investment.

- It focuses on enhancing the ease of doing business by streamlining regulations, reducing licensing requirements, and introducing digital platforms for faster approvals. Concurrently, significant investments are being made in modern infrastructure, including the creation of industrial corridors and smart cities with advanced technology and high-speed communication. Upgrades to existing infrastructure are also in progress to improve logistics and support innovation and industrial growth.

- **Pradhan Mantri Kaushal Vikas Yojana (PMKVY):** This skill development initiative aims to upskill and reskill workers, making them more adaptable to modern manufacturing technologies such as automation, robotics, IoT, and AI. By equipping workers with relevant skills, PMKVY helps ensure that India's workforce can meet the demands of advanced manufacturing industries.

- **Delhi-Mumbai Industrial Corridor (DMIC):** A major infrastructure project designed to enhance industrial growth; this corridor focuses on improving connectivity between key industrial hubs. It includes the development of smart cities, high-speed rail, and road networks, as well as logistics hubs that will reduce transport costs and improve the movement of goods. It aims to attract investments and boost manufacturing output across the region.

- **Dedicated Freight Corridors:** These specialized rail corridors are designed to facilitate the efficient movement of goods, particularly heavy and bulk commodities, across the country. The development of the Eastern and Western Dedicated Freight Corridors will significantly reduce logistics costs, improve delivery times, and support the manufacturing sector by enhancing the flow of raw materials and finished goods.

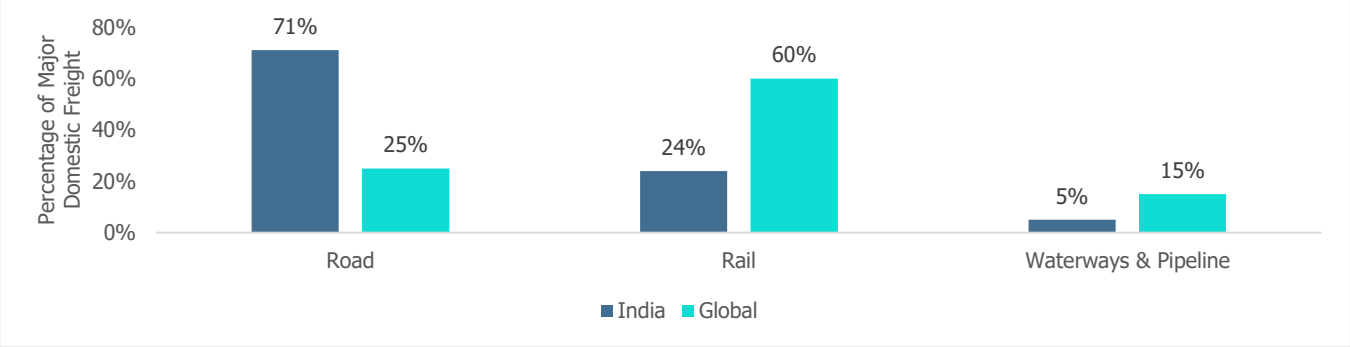
5. Overview of logistics sector in India

5.1 Trend of Logistics sector in India

India has been the world's fastest-growing major economy for four of the past five years, due to rising demand for goods and services. In FY24, India's annual merchandise exports declined to USD 437.06 billion, a decrease of 3.1% from FY23. In FY23, annual merchandise exports were USD 451.07 billion, an increase of 6.9% from FY22. India is inching closer to breaking into the top three trading partners in the world. To achieve that, it would require well integrated logistics policies.

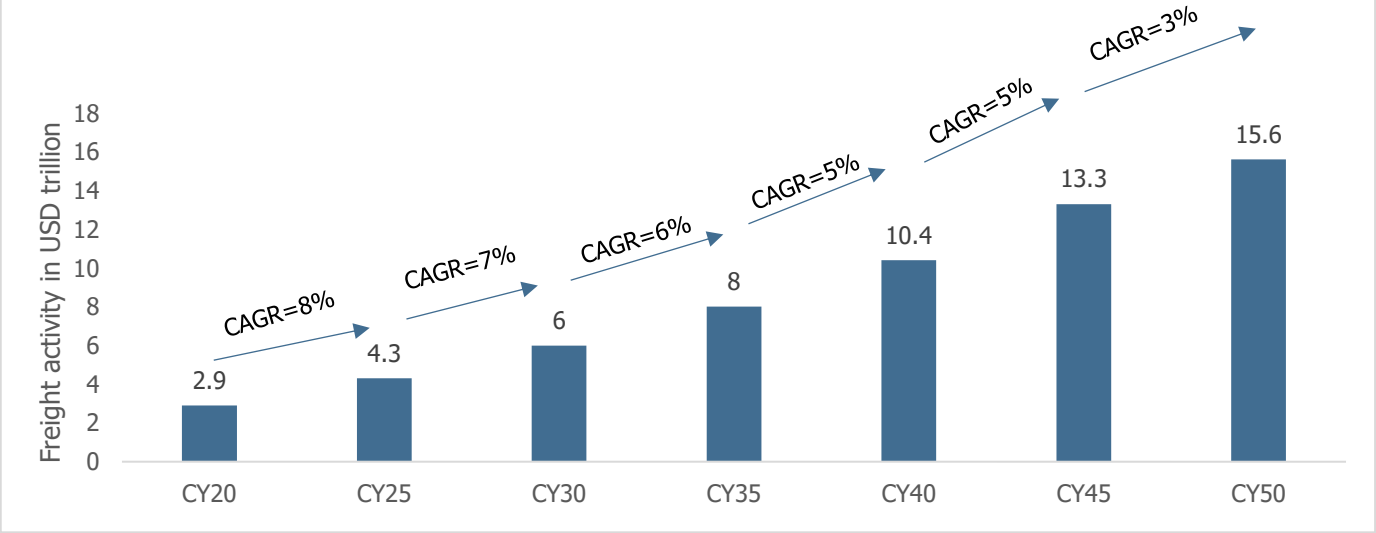
India handles 4.6 billion tonnes of goods each year, amounting to a total annual cost of INR 95,00,000 Mn. These goods represent a variety of domestic industries and products - 22% are agricultural goods, 39% are mining products and 39% are manufacturing-related commodities. Trucks and other vehicles handle most of the movement of these goods. Railways, coastal and inland waterways, pipelines, and airways account for the rest. Major domestic freight is still transported by road which accounts for 71% (25% globally) followed by rail - 24% (60% globally), waterways - 5% and balance through pipelines. Rail and road are the primary mode of logistics for domestic trade. Road is the dominant mode of transport which accounts for more than 70% of freight movement in India.

Chart 29: Share of Major Domestic Freight by Mode of Transport



Source: Ministry of Railways, Report of the Committee on Mission 3000 million tonnes, Industry Sources

Chart 30: Projected freight activity



Source: Niti Aayog, CareEdge Research

India's logistics sector, valued at INR 1,10,00,000 Mn, is a crucial component of its economy, comprising over 10,000 types of products and handling around 4.6 billion tonnes of freight annually. The sector is expected to grow significantly, reaching INR 2.9 lakh crore by 2020 driven by rising GDP, population, and consumer demand. With GDP growth of 32% between CY15 and CY20, India's freight demand surged by 28%. As income levels rise, exports grow, and sectors like e-commerce expand, goods movement is projected to increase at a 7% annual growth rate, reaching 15.6 trillion tonne-km by 2050. Road freight will dominate, with over three trillion kilometres expected to be travelled by freight vehicles. India's logistics infrastructure has improved, evidenced by a rise in its Logistics Performance Index (LPI) from 3.07 to 3.42 between CY07 and CY16, but challenges remain, as the country currently ranks 44th globally in logistics performance. There is still potential for improvement by addressing key areas outlined in the report.

5.1.1 Developments in logistics and warehousing

The warehousing industry has been growing steadily since FY18 when it was granted infrastructure status by the Government of India, which helped the industry in securing funding at lower costs, for longer duration and with enhanced limit. Better availability of financing coupled with growing demand from the FMCG, pharmaceuticals, 3PL and e-commerce industries has propelled the growth of the industry over the past few years.

India is well - positioned in terms of growth in the logistics and warehousing industry owing to surge in e- commerce and digitization. There is an increase in investments in this sector because of the scope of high growth. In FY22, there have been some large investments in this sector by large multinational companies such as Blackstone and Bain Capital.

Although there was slowdown in demand from the e-commerce sector, 3PL and manufacturing companies filled the gap ensuring growth in the sector in FY23 sustained the momentum of FY22. This also represents a shift in the sector's underlying demand base, which earlier relied on e-commerce sector.

The manufacturing sector and 3PL sector companies have further sustained momentum in growth in transaction volumes of the warehousing industry in FY24 as well. Additionally, stable domestic demand, expansion of rural markets, and government's thrust on infrastructure projects have further fuelled this growth.

About half of the warehousing stock comes from the tier 1 cities which includes Delhi, Mumbai, and Bengaluru. In 2023, net demand reached 40 million sq. ft, with about 70% for Grade A space, indicating a shift towards higher-quality spaces driven by increased hygiene and safety standards post-COVID-19. Life-time high registrations of warehouse were witnessed in FY23 - 1,522 warehouses were registered compared to previous high of 1,005 registrations in FY20.

Table 6: No. of Registered Warehouses

Sr. No.	Year	Warehouses Registered (Nos.)
1	FY16	588
2	FY17	214
3	FY18	261
4	FY19	607
5	FY20	1,005
6	FY21	337
7	FY22	610
8	FY23	1,522
9	FY24	2,184

Source: WRDA

5.2 Ecommerce and Q-commerce in India driving the warehouses demand.

E-commerce in India has experienced growth in recent years, driven by increasing internet penetration, smartphone usage, and a growing middle class with rising disposable incomes. The sector is diverse, encompassing everything from online retail and grocery shopping to digital services and entertainment. Major players like Amazon, Flipkart, and Reliance are competing with newer entrants, while niche platforms cater to specialized segments like fashion, electronics, and local goods. Government initiatives such as Digital India and the expansion of the Unified Payments Interface (UPI) have played a pivotal role in fostering the growth of e-commerce by improving digital infrastructure and making transactions seamless. E-commerce in India is expected to continue expanding, driven by the increasing preference for convenience, the rise of online payment systems, and the growing adoption of e-commerce in smaller cities and rural areas.

Q-commerce has quickly changed the retail and last-mile delivery scene in India due to the rising need for quick, effective, and convenient services. Due to the widespread use of mobile internet and the increase in online shopping, especially for groceries and essential items, q-commerce has become a dominant player in the nation's e-commerce industry. As of 2023, the gross merchandise value (GMV) of quick commerce in India had surged to US$ 2.3 billion, marking a growth of more than 70% compared to the year before. It is estimated that the sector will experience a CAGR of 27.9% from FY22 to FY27.

Leading players such as Blinkit owned by Zomato, Swiggy Instamart, Dunzo, as well as newcomers like Zepto are fuelling this expansion. These services use technology, such as sophisticated algorithms, data analytics, and route optimization, to achieve incredibly speedy deliveries. The Q-commerce models have developed from traditional central warehouses to smaller warehouses, or "dark stores" placed nearer to consumers, resulting in quicker delivery times, usually within 10-20 minutes.

6. Pre-Fabricated and Pre-Engineered construction industry in India

6.1 Overview of supply-side trend segment

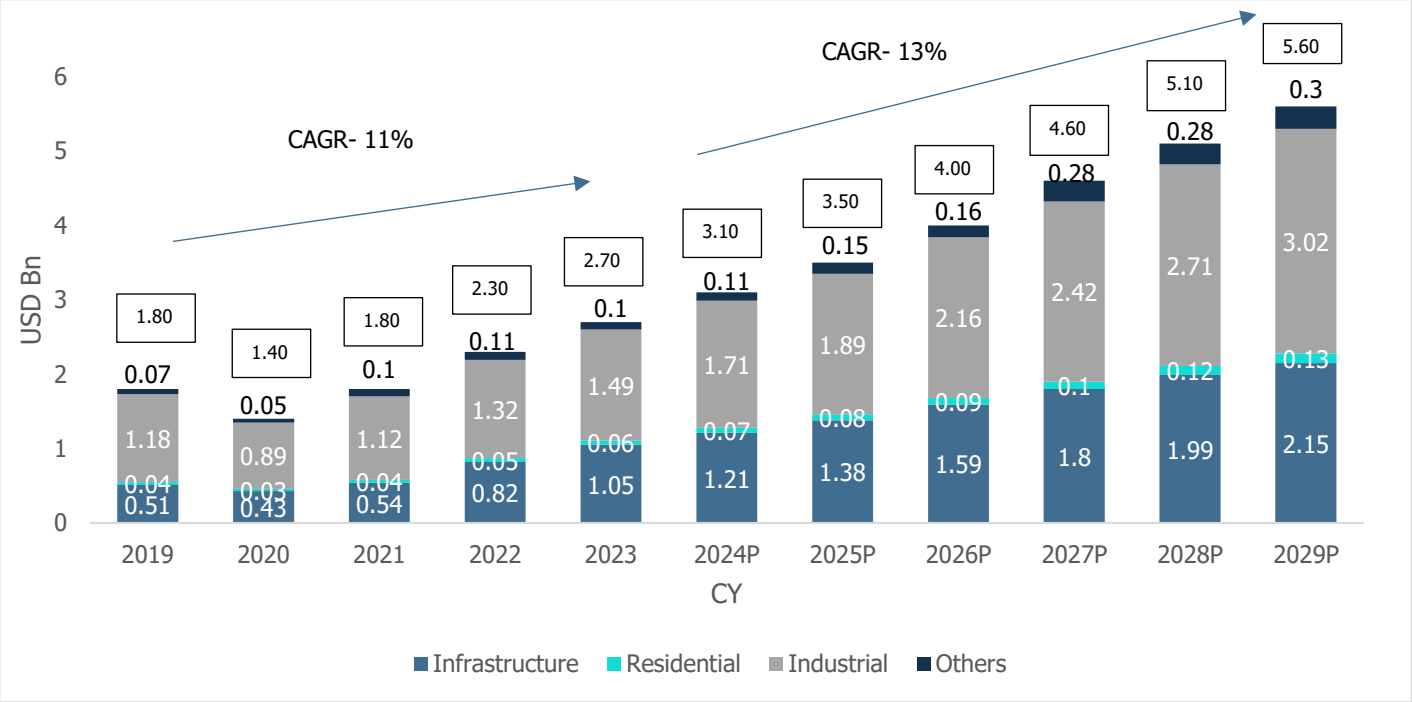
6.1.1 Trend in Industry size of Pre-Fabricated and Pre-Engineering Industry -by types

The Construction industry is broadly divided into residential, industrial and infrastructure construction. Pre- Engineering Industry can also be divided into the above categories.

Pre-Engineering Construction Market

The PEB market is expected to grow at a CAGR of 13% from CY24 to CY29 driven by the growth in the construction sector and demand for quick construction and sustainable buildings, with the highest growth anticipated in warehouses, cold storage, and data centres. The market is majorly dominated by industrial construction.

Chart 31: Market Size of PEB in various construction sector



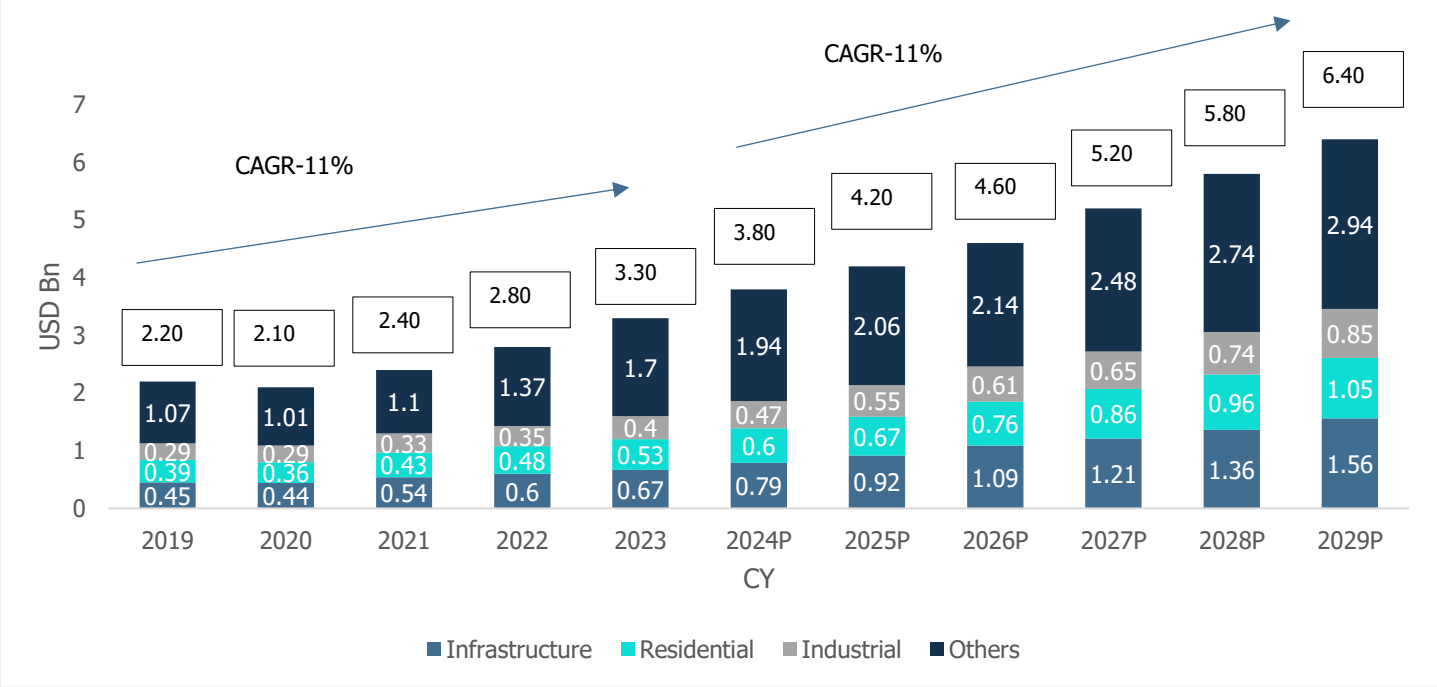
Source: Maia Research, CareEdge Research

Onsite project management capabilities are a pivotal factor in the evaluation of pre-engineered steel building suppliers as construction industry is usually riddled by long projects. Hence, project management expertise becomes extremely important to ensure timely completion and avoid costs overrun as it helps in the adherence to timelines, budget constraints, and high-quality standard.

Pre- fabricated Construction Market

The Pre- fabricated construction market is expected to grow at a CAGR of 11% from CY24 to CY29 driven by the overall demand in the construction sector. The market is dominated by infrastructure sector because it is convenient to construct large constructions using Pre-fabricated methods.

Chart 32: Market Size of Pre- Fabricated in various construction sector



Source: Maia Research, CareEdge Research

6.1.2 Overview of key players and manufacturing landscape in pre-fabrication and pre-engineering industry

The manufacturing landscape of the prefabricated and pre-engineered building industry in India is evolving rapidly, driven by factors like the push for affordable housing, industrial growth, urbanization, and the demand for sustainable building practices.

Company	Sector Focus	Projects	Production Capacity (MT/ annum)
Epack Prefab	Epack is a player in the Indian construction industry, with a presence in prefabricated and pre-engineered buildings. The company is involved in both the design and manufacturing of pre-engineered buildings, especially in sectors like industrial construction, warehouses, commercial spaces, and affordable housing.	Epack has been involved in several large-scale projects, including factories, warehouses, airports, and residential complexes where prefabricated and pre-engineered solutions have been used.	1,33,924

Kirby Building Systems	Kirby is a leader in pre-engineered steel buildings (PEBs) in India, specializing in steel structures for a wide range of applications, including warehouses, factories, industrial sheds, commercial buildings, and storage facilities.	Kirby's structures have been used in a variety of sectors, including automobile manufacturing, warehousing, distribution centres, and retail.	3,00,000
Phenix Construction Technologies	Phenix is Pre-Engineered Buildings ("PEBs") provider with installed capacity of 103,800 MTPA, having two manufacturing facilities – one at Sanand, Gujarat and another at Cheyyar, Tamil Nadu.	Phenix has supplied buildings for several large industries and companies across India, construction of bridges, flyovers, power plant structures and other industrial applications.	1,03,800
Zamil Steel Buildings	Zamil Steel, a part of Zamil Group, is a leading manufacturer of pre-engineered buildings and steel structures in India, providing solutions for industrial, commercial, and residential projects.	Zamil Steel has completed numerous large-scale industrial and commercial projects, including warehouses, factories, and logistics hubs.	1,00,000
Everest Industries	Everest Industries is an Indian company that primarily focuses on the manufacturing and marketing of building products and solutions. It is known for its range of pre-engineered buildings, roofing solutions, and other construction materials.	Everest Industries is involved in several infrastructure projects, including industrial buildings warehouses, Hangars etc.	72,000
Interarch Building Products Ltd	Interarch provides turnkey pre-engineered steel construction solution providers in India with integrated facilities for design and engineering, manufacturing, on-site project management capabilities for the installation and erection of pre-engineered steel buildings.	Interach Building Products Ltd has provided PEBs for indoor stadiums, warehouses and various industrial and residentials applications. for	1,61,000

6.1.3 Structure of the Industry

The structure of the prefabricated and pre-engineered (PEB) industry is organized into several segments that cater to diverse types of construction and industrial needs. This industry primarily revolves around the manufacturing of

components (like walls, floors, roofs, etc.) in a factory, which are then transported to the construction site for assembly. It is widely used in sectors like commercial, industrial, residential, and infrastructure projects.

The PEB and prefabricated building markets have both organized and unorganized segments, with the organized sector being dominated by large players that adhere to industry standards and regulations. Here is a breakdown of the market:

a. Organized Sector consisting Key Players

- **Large EPC Companies**: These companies manage large projects and often lead the market in terms of volume. They have established relationships with clients across sectors like infrastructure, industrial, commercial, and residential. They take the EPC contract and outsource the PEB parts.
    - Example: Larsen &Turbo, Tata Projects, etc.
- **Manufacturers of Prefabricated Systems and Components**: These are large firms that design, manufacture, supply, and erect prefabricated components such as steel frames, walls, roof panels, and modular structures.
    - Examples: Ardee Engineering, Tata BlueScope Steel, Zamil Steel, Interarch, Everest Industries, and Kirby Building Systems.
- **Project Management and Construction Firms**: These firms provide end-to-end solutions and manage large prefabricated or pre-engineered building projects. They offer services from design to construction.

b. Unorganized Sector

- **Small & Medium Enterprises (SMEs)**: This segment consists of smaller, regional players that may lack the technological sophistication and larger-scale manufacturing capabilities of the organized sector. They typically cater to local markets or small-scale projects.
- **Local Fabricators**: Smaller companies often handle only specific components like steel frames, panels, or roofing systems, serving niche markets.
- **Contractors**: There are many local or regional contractors who deal with smaller scale prefabrication projects, and they may not follow the same industry standards as the larger companies.

6.1.4 Regulatory Framework for the Industry

Key Regulatory Aspects Governing the Prefabricated and Pre-Engineered Building Industry in India

1. Building Codes and Standards

The Bureau of Indian Standards (BIS) is responsible for formulating and enforcing technical standards for construction materials and practices, including for prefabricated and pre-engineered buildings.

- IS 800: 2007 – General Construction in Steel - Code of Practice
- IS 875 (Part 2) – Code of Practice for Design Loads
- IS 2062: 2011 – Steel for General Structural Purposes

2. National Building Code of India (NBC) 2016

The National Building Code (NBC) of India provides a comprehensive set of guidelines and standards for building design, construction, and safety. It covers all aspects of construction, including prefabricated and pre-engineered buildings, and establishes minimum standards for building safety, including:

- **Structural Safety**
- **Fire and Safety Regulations**
- **Energy Efficiency**

3. Environmental Regulations

India's regulatory landscape also includes specific environmental and sustainability standards to promote green and energy-efficient buildings.

- **Environmental Impact Assessment (EIA):**
  Under the Environment Protection Act, 1986, the EIA Notification (2006) requires an environmental impact assessment for certain construction and infrastructure projects.
- **Green Building Certifications:**
  LEED India (Leadership in Energy and Environmental Design) certification is a globally recognized standard for green buildings. BREEAM (Building Research Establishment Environmental Assessment Method) and IGBC (Indian Green Building Council) certifications are also popular in India and encourage the adoption of eco-friendly building materials and technologies.

6.1.5 Porter's five forces analysis of the Industry

1. Threat of New Entrants

	Threat of New Entrants
Barriers to Entry	The entry barriers for inexperienced players in the prefabricated and pre-engineered building industry are relatively low, especially for modular construction and prefabricated components. Basic manufacturing facilities can be established without large-scale capital investment, and technology adoption is increasingly accessible. However, in high-end PEBs and large-scale commercial projects, substantial investment in advanced technologies (e.g., automated fabrication processes) and certifications (e.g., ISO, IS standards) is required.
Threat from New Entrants	The growth potential in India's infrastructure, housing, and commercial sectors makes the market attractive to new entrants. Local players can enter the market with a focus on affordable housing, modular homes, or specialized industrial buildings. However, brand recognition, quality standards, and distribution networks will be critical to competing against established players.
Government Support	India's policy initiatives such as the PMAY (Pradhan Mantri Awas Yojana) and Make in India provide support to new entrants, especially in affordable housing and modular construction. Government incentives for green buildings and pre-engineered steel may encourage start-ups and smaller companies to enter the industry.

2. Bargaining Power of Suppliers

	Bargaining Power of Suppliers
Concentration of Suppliers	The supply chain for materials such as steel, precast concrete, insulation materials, and cladding for prefabricated and pre-engineered buildings is concentrated among a few large suppliers in India. Major steel producers like Tata Steel, JSW Steel, and Jindal Steel dominate the market. Raw material costs, particularly steel and aluminium, significantly impact the overall cost structure of pre-engineered buildings, giving suppliers considerable bargaining power, especially when the global prices of these materials fluctuate.
Switching Costs	The cost of switching suppliers for specialized materials (e.g., pre-fabricated panels or steel beams) can be high due to the quality, consistency, and regulatory requirements involved in construction. However, in terms of modular and smaller-scale prefabricated projects, alternative suppliers or local vendors can be explored, reducing the bargaining power of key suppliers
Technology and Innovation	Suppliers that can provide innovative materials (e.g., lightweight concrete panels, energy-efficient insulation, advanced steel for PEBs) may have higher bargaining power, as these innovations are in demand for green buildings and sustainability.

3. Bargaining Power of Buyers

	Bargaining Power of Buyers
Buyer Characteristics	The buyers in this industry include real estate developers, industrial businesses, government agencies, and housing authorities. These buyers often have substantial purchasing power, especially when they represent large-scale infrastructure or affordable housing projects. The government (through schemes like PMAY or smart city initiatives) is a significant buyer of prefabricated housing solutions, giving it substantial bargaining power in terms of pricing and contractual terms.
Customization and Differentiation	The degree of customization available in prefabricated buildings affects buyer power. If buyers can demand customized designs, the bargaining power of buyers increases, as they can push for competitive pricing and features that match their needs. However, high-quality pre-engineered buildings (PEBs) or highly specialized projects often offer fewer choices and increase the power of suppliers and contractors who are in control of advanced construction technologies.
Availability of Alternatives	If buyers are looking for cost-effective housing solutions, prefabricated buildings offer a clear alternative to traditional brick-and-mortar construction, but for large-scale commercial projects, they may have fewer options. This reduces the buyer power in high-value or specialized projects.

4. Threat of Substitutes

	Threat of Substitutes
Traditional Construction	Conventional construction methods (brick and mortar, concrete, etc.) remain a significant substitute, especially for residential and small-scale projects. These methods have been the standard for decades and are often perceived as more durable and established, despite the growing adoption of pre-fabrication techniques.
Alternative Technologies	New construction technologies, such as 3D printing, modular homes, and rammed earth construction, are emerging as substitutes to prefabricated buildings. However, these technologies are still at an early stage of adoption in India and are not yet widely commercialized at scale, so their threat remains moderate.
Sustainability Trends	Prefabricated and pre-engineered buildings are often seen as more sustainable and environmentally friendly than traditional methods. This is a key competitive advantage for PEBs, but substitutes that focus on green construction, like solar-powered homes or eco-friendly materials, may pose a challenge in the long term.

5. Industry Rivalry

	Industry Rivalry
Number of Competitors	The prefabricated and pre-engineered building industry in India is highly competitive, with numerous local and international players like L&T, Kirby, Zamil Steel, Tata BlueScope, Jindal, Vinar Systems, and smaller regional companies competing for market share. There is intense competition in the market, especially for industrial PEBs, warehouses, and affordable housing, where players compete based on price, quality, and speed of delivery.
Growth of the Market	The growing demand for affordable housing and industrial infrastructure in India ensures an elevated level of competition among industry players to capture a share of the expanding market. Companies that can offer innovative designs, energy-efficient solutions, and cost-effective construction will have a competitive advantage.

6.2 Overview of demand- side trend in the segment

6.2.1 Key Demand Drivers for the Industry

Demand Drivers	Description
Technical Factors	The integration of automation and digital technologies in the design and manufacturing of prefabricated components has significantly improved construction efficiency. These technologies enable faster assembly, better quality control, and reduced material waste. Additionally, modular construction

Demand Drivers	Description
	techniques allow for quick assembly of pre-designed units, reducing on-site time and labour costs, making prefabricated buildings ideal for affordable housing and industrial uses.
Time and Cost Factors	With components like steel, panels, and roofing pre-manufactured in factories, on-site assembly is much faster than traditional methods, leading to quicker project completion. This is especially valuable for large-scale infrastructure, commercial buildings, and affordable housing projects. Prefabricated buildings (PEBs) also offer cost savings through economies of scale, better cost control, less waste, and more efficient use of materials.
Environmental Impact and Benefits	The PEB industry in India contributes to sustainable construction by reducing carbon emissions compared to traditional methods. Off-site manufacturing minimizes material waste, energy consumption, and emissions. The use of recyclable materials, like steel and aluminium, supports a circular economy, reducing the need for raw resources.
Growth in Demand for Industrial Structures	India's push to become a global manufacturing hub is increasing demand for cost-effective, scalable industrial buildings such as warehouses, factories, and logistics hubs. The growth of e-commerce, retail, and logistics further fuels the need for large, modern warehousing facilities that can be quickly constructed.

Key Pros in Pre-Fabricated and Pre- Engineering Construction Industry

Pros	Description
Faster Time of construction	Prefabricated and pre-engineered buildings (PEBs) significantly reduce the time required for construction. With components manufactured off-site in controlled factory conditions, on-site assembly is faster and more streamlined. This accelerated construction process helps developers meet tight deadlines and reduces disruptions, making PEBs an attractive solution for both residential and commercial projects.
Cost-Effectiveness	Prefabricated construction offers substantial cost savings compared to traditional methods. The use of standardized components and mass production in factories allows for better economies of scale, lower material costs, and reduced Labour expenses. Additionally, the shorter construction time leads to lower overheads and operational costs, making PEBs a cost-effective alternative for developers and end-users.
Control over quality	With pre-fabrication taking place in factory-controlled environments, there is a higher level of consistency and quality in the production of components. Stringent quality checks and automated processes reduce the chances of errors or defects that are more common in on-site construction. This leads to better structural integrity, enhanced safety, and more durable buildings.

Pros	Description
Sustainability of the buildings	PEBs are typically more sustainable than traditional buildings due to their efficient use of materials, reduced waste, and the ability to incorporate energy-efficient solutions such as solar panels or insulated walls. The use of recyclable materials, like steel and aluminium, and the potential for disassembly and reuse at the end of a building's life cycle further contribute to the environmental benefits of prefabricated construction.
Design Flexibility and Customization	Modern prefabricated buildings offer a high degree of design flexibility. Advanced manufacturing technologies, like BIM (Building Information Modelling), allow for precise customization of buildings to suit specific needs and preferences. PEBs can be adapted for a wide range of applications, from residential homes to industrial warehouses, providing developers with a tailored solution to meet the unique demands of each project.

- **Key Challenges of Pre-Fabricated and Pre- Engineering Construction Industry**

Challenges	Description
High Initial Investment	While the long-term cost benefits of PEBs are significant, the initial investment required for setting up manufacturing facilities and acquiring advanced construction technologies can be quite high. This capital expenditure may be a barrier for smaller players or new entrants in the market. Additionally, factory setup costs, training, and supply chain establishment can delay returns on investment.
Logistical and Transportation Challenges	The transportation of prefabricated components from manufacturing facilities to construction sites can be challenging, particularly in remote or rural areas. Large, bulky items require specialized transportation, which can increase costs and lead to potential delays. Moreover, the prohibitive cost of logistics can be a barrier for projects in geographically challenging locations or those with limited infrastructure.
Design and Engineering Limitations	Despite technological advancements, there are still certain design limitations when using prefabricated elements. While customization is possible, prefabricated components must adhere to standardized manufacturing processes, which can limit architectural flexibility. Complex or highly innovative designs that do not align with standard pre-fabrication methods may face challenges in terms of structural integrity or cost-effectiveness.
Dependency on Supplier Reliability	The success of prefabricated construction depends heavily on the timely delivery and quality of components from suppliers. Delays in the manufacturing process, transportation issues, or supply chain disruptions can significantly impact project timelines and budgets. Therefore, strong relationships with reliable suppliers and effective supply chain management are essential for minimizing risks and ensuring smooth project execution.

7. Overview of Material Handling and Processing System and Equipment in India

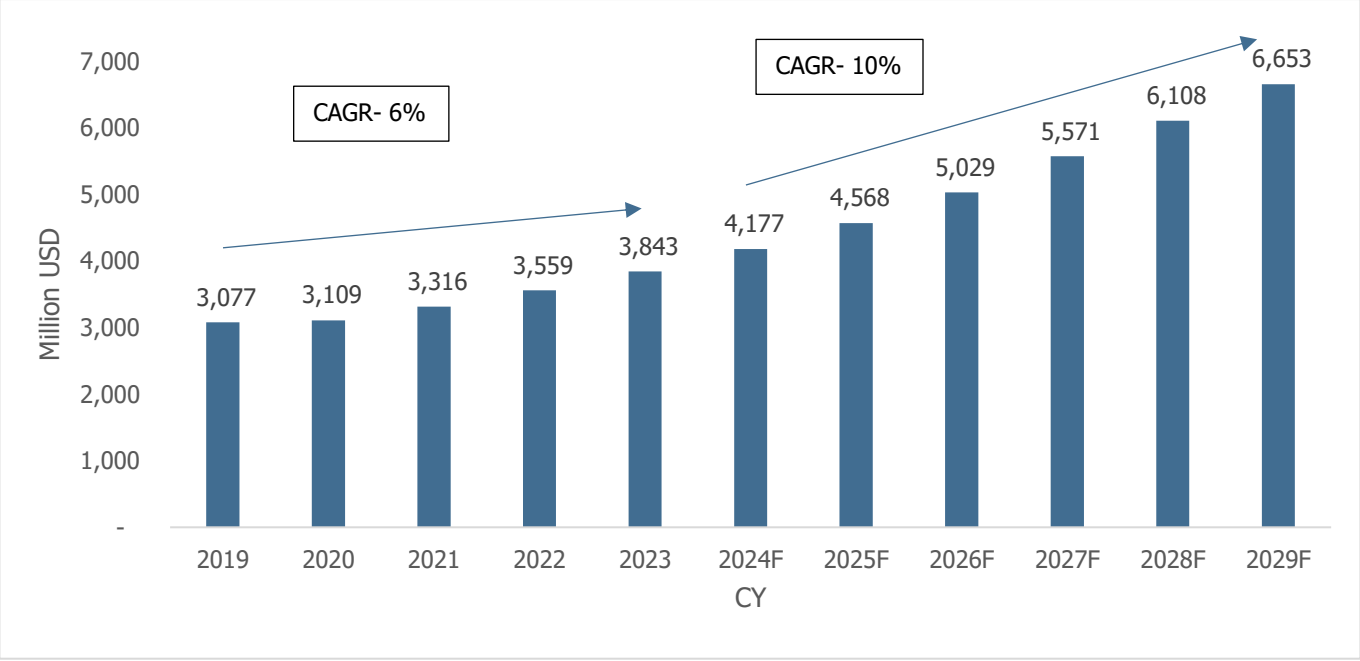
7.1 Overview of Material Handling System market in India

The material handling system (MHS) market in India is growing rapidly, driven by the expanding industrial base, rising e-commerce, and the increasing demand for automation in manufacturing. MHS involves the movement, storage, protection, and control of materials throughout production, warehousing, distribution, and consumption stages.

The main goal is to improve efficiency, minimize manual labour, reduce material damage, and ensure smooth goods flow in the supply chain. By automating material movement, these systems streamline operations, reduce errors, and lower costs. Well-designed MHS are essential for maintaining productivity, safety, and compliance with quality standards. Efficient systems are crucial for optimizing supply chain performance in manufacturing, warehouses, and distribution centres.

As India's manufacturing sector focuses on global competitiveness, adopting advanced MHS is vital for operational excellence and sustainability. The material handling industry supports smooth processing across sectors, with Engineering Procurement and Construction (EPC) services providing solutions for power, steel, mines, ports, and specialty conveyors. EPC services in material handling integration have grown with India's industrialization, offering end-to-end solutions from design to post-installation support. With India's expanding manufacturing and logistics sectors, the demand for sophisticated EPC solutions focused on sustainability, energy efficiency, and digitalization will continue to rise.

Chart 33: Trend in Material Handling System Market in India



Source: Maia Research, CareEdge Research

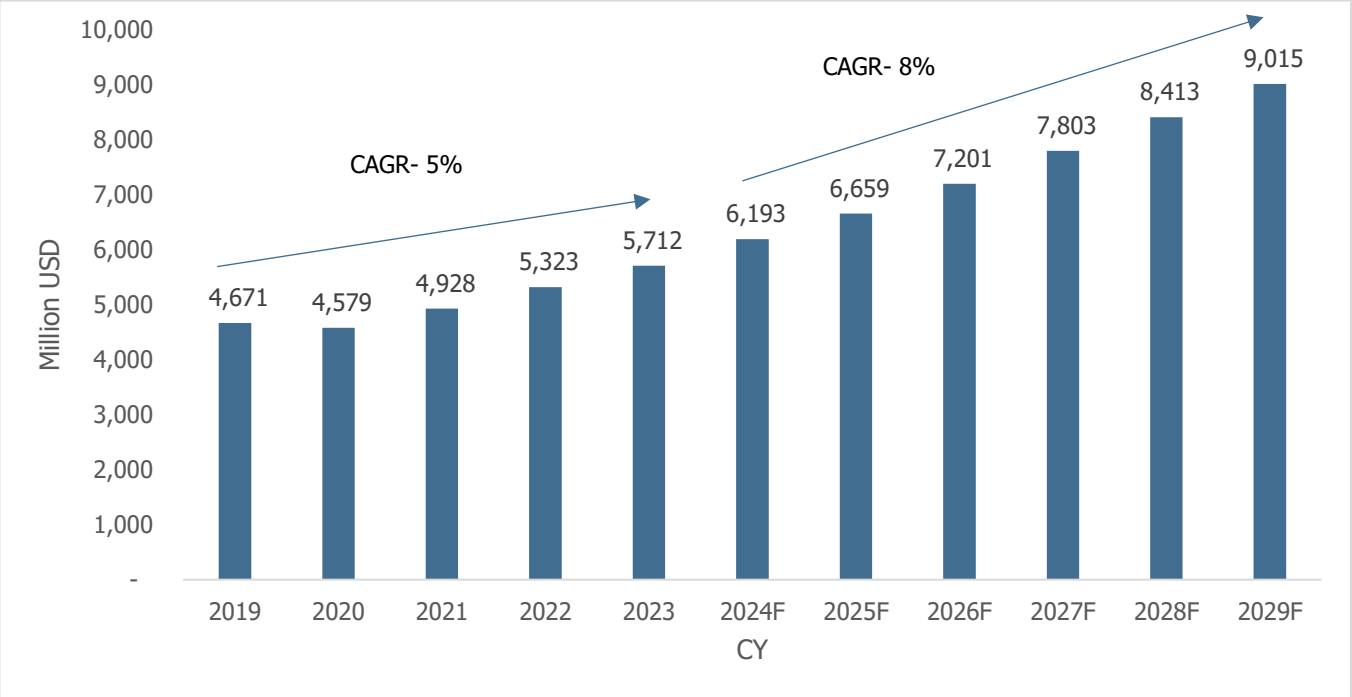
The Material Handling System Market in India is expected to grow at a CAGR of 10% from CY24 to CY29 to reach USD 6,653 Million driven by increase in industrializations, ecommerce, improvement in Infrastructure in India.

7.2 Overview of Material Processing System Market in India

The material processing system market in India is experiencing significant growth, driven by the country's expanding industrial sectors, including mining, manufacturing, construction, and automotive. This market includes a wide range of equipment such as crushers, grinders, screening systems, conveyors, and sorters, catering to industries like mining, cement, steel, and chemicals. Examples of material processing systems are – mineral beneficiation, coal washeries, custom engineered solutions used in process industries.

The material processing system market grew at a CAGR of 5% from CY19 to CY23 and it is expected to grow at a CAGR of 8% from CY24 to CY29 driven by industrialization and infrastructure development are major growth drivers, with sectors such as construction, mining, cement, and steel seeing robust expansion.

Chart 34: Trend in Material Processing System Market in India

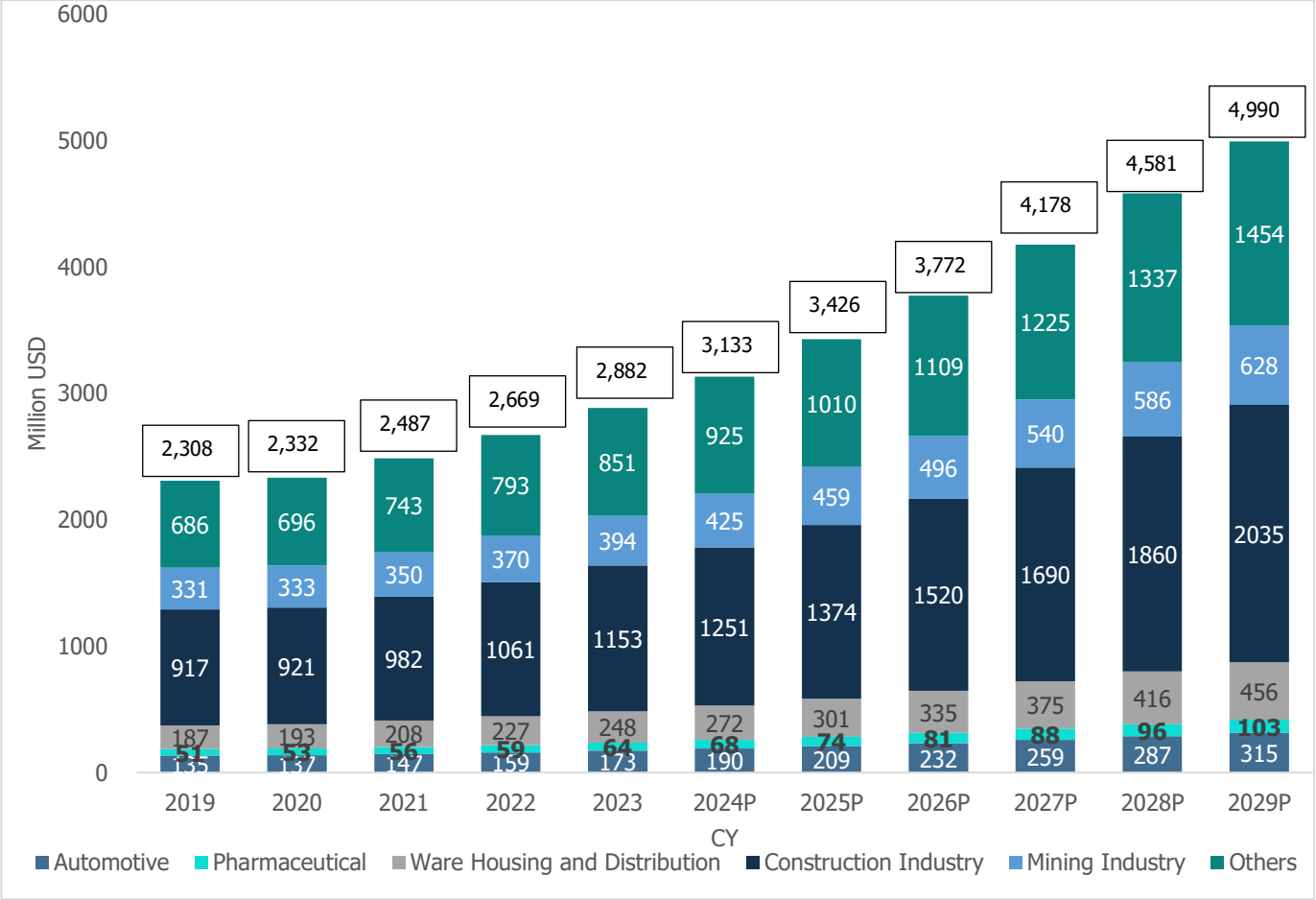


Source: Maia Research, CareEdge Research

7.3 Market Size of Material Handling Equipment Segment- by user

Material handling is applicable across various industries. Material handling systems are used in various industries and settings to efficiently process, move, store, control, and protect materials and products throughout the manufacturing, warehousing, and distribution processes. It involves the use of manual, semi-automated, and automated equipment to facilitate the movement and storage of materials within the warehouse.

Chart 35: Market Size of Material Handling Equipment Market in various Industries



Source: Maia Research, CareEdge Research

Automotive:

India's automotive sector is adopting advanced material handling systems (MHS) to enhance efficiency, reduce costs, and meet the demand for higher production volumes and faster delivery times. The market for material handling equipment in the automotive sector grew at a CAGR of 6% from CY19 to CY23 and is projected to grow at 11% from CY23 to CY29.

Pharmaceutical:

The pharmaceutical sector in India is increasingly using advanced material handling equipment (MHE) to meet demands for efficiency, safety, and regulatory compliance. The market for MHE in the pharmaceutical sector grew at a CAGR of 6% from CY19 to CY23 and is expected to grow at 8% from CY23 to CY29, driven by automation, smart technology, enhanced compliance, and sustainability.

Warehousing and Distribution:

The MHE market in India's warehousing and distribution sector is growing rapidly due to the rise in e-commerce, retail, and the need for efficient supply chain operations. From CY19 to CY23, the market grew at a CAGR of 7% and is expected to grow at 11% from CY23 to CY29, driven by automation, smart technologies, lean practices, and sustainability.

Construction:

In India's construction industry, the demand for advanced material handling equipment (MHE) is increasing due to automation and mechanization aimed at improving efficiency, reducing labour dependency, and enhancing safety. The market for MHE in construction grew at a CAGR of 6% from CY19 to CY23 and is expected to grow at 10% from CY23 to CY29.

Mining:

In India's mining sector, the adoption of material handling equipment (MHE) is evolving to meet demands for efficient, safe, and sustainable operations. Automated solutions like conveyor systems, haul trucks, and draglines are increasingly used to transport materials like coal and ores. The MHE market in mining grew at a CAGR of 4% from CY19 to CY23 and is projected to grow at 8% from CY23 to CY29.

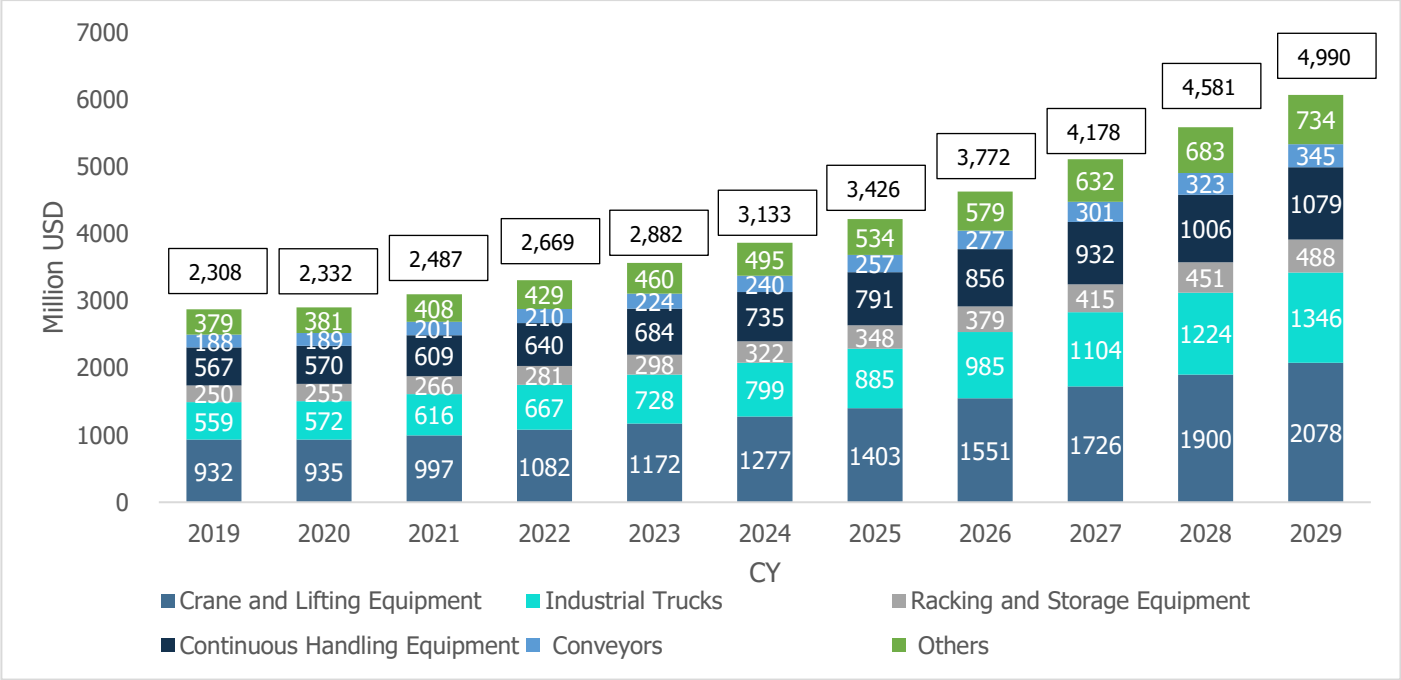
7.4 Types of Material Handling Systems and Material Processing Systems

Material handling systems can be classified into several types based on the materials being moved, the level of automation, and the specific tasks they are designed to perform. Bulk material handling systems, which focus on the movement of enormous quantities of raw materials, are critical in industries like mining, cement, and agriculture. Material Handling Systems refers to automated handling equipment systems, including cranes, racking and storage equipment, Warehouse robots, etc.

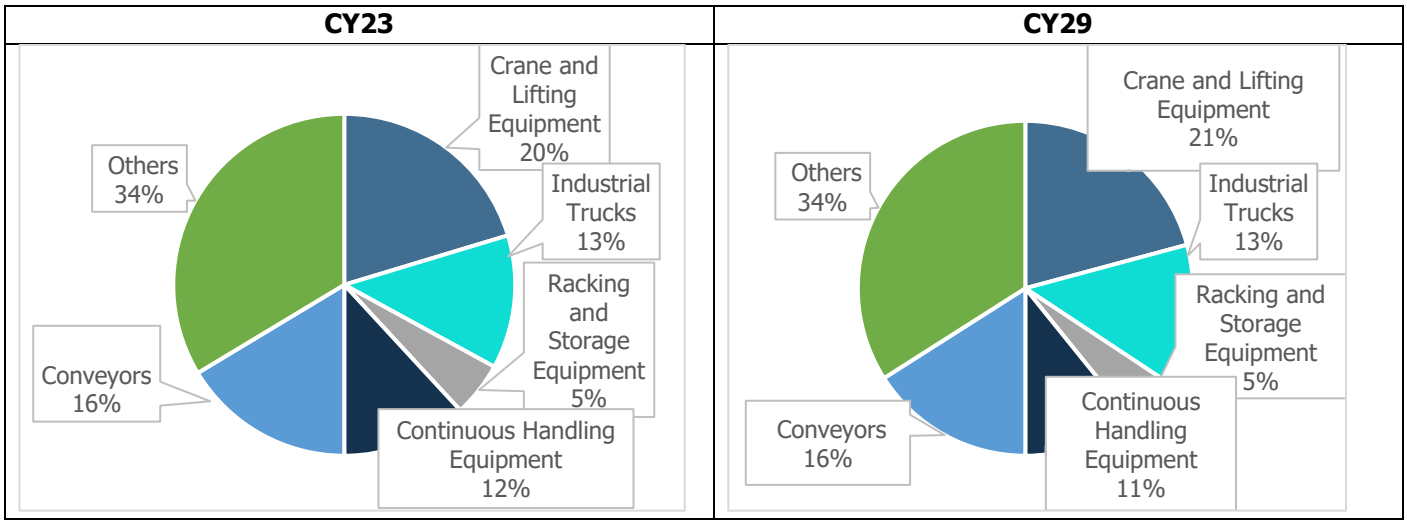
As industries evolve, the integration of automated, semi-automated, and even robotic material handling systems is becoming increasingly important to meet the demands for efficiency, safety, and environmental sustainability.

The Material Handling System is the integration of specific equipment aligned in the desired manner to transport material from one place to another. Material handling equipment is classified into four main categories: storage and handling, bulk material, industrial trucks, and engineered systems.

Chart 36: Trend in Material Handling Equipment Market in India



Source: Maia Research, CareEdge Research



Source: Maia Research, CareEdge Research

Crane and Lifting Systems:

The market for cranes and lifting systems in India has grown significantly from 2019 to 2029, driven by infrastructure development, industrial expansion, and urbanization. Increasing automation demand in construction, mining, and manufacturing sectors, along with rising labour costs and safety regulations, is boosting the adoption of automated lifting solutions.

Industrial Trucks:
With the growth of warehousing and distribution, especially due to e-commerce, demand for material handling equipment like forklifts and pallet trucks has surged. From 2023, the market is shifting toward electric industrial trucks, aligning with sustainability trends. By 2029, electric vehicles (EVs) and a growing rental and leasing market will offer cost-effective and flexible solutions for businesses.

Racking and Storage Systems:
As urbanization and consumer demand for fast deliveries rise, businesses are investing in efficient storage solutions. From 2023, the trend is shifting to advanced racking systems like automated storage and retrieval systems (ASRS), enhancing warehouse automation and reducing labour costs. The focus on sustainability is driving the adoption of eco-friendly and durable materials in storage equipment.

Continuous Handling Equipment:
Industries like mining, cement, automotive, and logistics are increasingly adopting continuous handling equipment such as conveyors, chutes, and automated systems to improve efficiency and reduce labour costs. As infrastructure and industrial projects expand, the focus is on automation, efficiency, and energy-efficient, environmentally sustainable equipment.

Conveyors:
As industries such as automotive, food and beverage, pharmaceuticals, and manufacturing grow, the need for efficient, automated material handling solutions has increased. From 2023, there's a shift towards smart conveyors with real-time tracking, predictive maintenance, and improved efficiency. The demand for energy-efficient conveyors and eco-friendly materials is rising, with a focus on customized, flexible solutions and greater adoption of automation and robotics for faster production and distribution processes.

7.5 Advantages of Material Handling System

Increased Efficiency	A well-designed material handling system significantly improves the efficiency of operations by automating the transportation, storage, and retrieval of materials. With systems such as conveyors, businesses can move materials faster and more consistently compared to manual handling. This reduction in time spent on material handling activities leads to smoother workflows and more productive operations, allowing companies to meet tighter deadlines and increase throughput.
Reduced Labour Costs	Automation in material handling systems reduces the need for manual labour, lowering the overall workforce requirements. By using equipment like forklifts, cranes, and automated storage systems, businesses can decrease the reliance on human workers for repetitive, strenuous tasks. This leads to a reduction in labour costs, as well as minimizing the risks of human error and injury, which are common in manual material handling operations.
Improved Safety	Material handling systems, particularly those involving automation and mechanized equipment, enhance workplace safety by reducing human involvement in potentially hazardous tasks. Automated cranes, conveyors, and other equipment can move heavy and dangerous materials without exposing workers to risks such as heavy lifting injuries, accidents, or exposure to harmful substances. This helps organizations comply with safety regulations and create a safer working environment.

Better Space Utilization	Material handling systems optimize the use of space within a facility, warehouse, or production plant. Automated storage and retrieval systems (AS/RS) and vertical storage systems allow companies to store materials in a more compact, organized manner, maximizing the available space. This is especially beneficial in industries where space is limited and can help businesses avoid the need for costly expansions or relocations.
Enhanced Inventory Control	By integrating material handling systems with inventory management software, companies can achieve better control over their stock. These systems provide real-time data on the location and status of materials, improving visibility and tracking. This leads to fewer stockouts, reduced excess inventory, and better forecasting, ultimately improving the accuracy of orders and reducing inventory-related costs.
Improved Product Quality	A good material handling system ensures that materials are moved, stored, and processed with care, which helps maintain product quality. Automated systems are less likely to cause damage to goods compared to manual handling, especially for fragile or sensitive materials. For example, the use of conveyor belts designed to minimize vibrations and shocks can help ensure that products reach their destination in optimal condition.
Increased Flexibility	Modern material handling systems are designed to be flexible and adaptable to distinct types of materials and operational needs. Automated equipment can be reconfigured to handle different product sizes, weights, and shapes, allowing companies to adjust quickly to changes in demand or production processes. This flexibility helps businesses respond more efficiently to market fluctuations, product changes, or seasonal demand shifts.
Cost Savings	While the initial investment in a material handling system can be substantial, the long-term cost savings are significant. Automation reduces the need for labour, minimizes operational downtime, reduces product damage, and enhances overall productivity. These efficiencies translate into lower operational costs, higher throughput, and improved profitability over time.

7.6 Overview of key players and manufacturing landscape in Material Handling System

Company	Sector Focus	Projects
Larsen & Toubro Limited	Larsen & Toubro Limited, incorporated in 1938, is a leading Indian multinational company renowned for its expertise in engineering, construction, and manufacturing. In the field of Pre-Engineered Buildings (PEBs), L&T offers innovative, cost-effective, and sustainable solutions for industrial, commercial, and infrastructure projects.	Larsen & Toubro Limited (L&T) has been instrumental in executing numerous material handling systems projects across India, particularly in sectors such as power, steel, mining, and ports.

Kalpataru Projects International Limited	Kalpataru Projects International Limited (KPIL), incorporated in 1981, is a leading global engineering, procurement, and construction (EPC) company specializing in power transmission and distribution, railways, oil and gas pipelines, and civil infrastructure.	Kalpataru Projects International Limited (KPIL) is a prominent Engineering, Procurement, and Construction (EPC) company in India, specializing in sectors such as power transmission and distribution, buildings and factories, water supply and irrigation, railways, oil and gas pipelines, urban mobility, highways, and airports.
Macmet Engineering Limited	Macmet Engineering Limited, incorporated in 1974, is a leading Indian company specializing in the design, engineering, and manufacture of material handling systems and water infrastructure projects. It is renowned for its expertise in supplying overland belt conveyors, pipe conveyors, and other advanced bulk material handling solutions for industries such as power, steel, cement, and mining.	Macmet Engineering Limited (MEL) is a leading provider of bulk material handling solutions and water screening equipment in India, serving core sectors such as cement, power, steel, mining, and ports.

Note: Although L&T and Kalpataru Projects International Limited are key MHS players, they operate at a much larger scale

7.7 Overview of Mining Sector

The growth of the mining sector directly influences the demand for **material handling** and **material processing systems** in several keyways. As mining activities increase and evolve, there is a higher need for efficient, safe, and scalable systems to manage the movement, processing, and storage of extracted materials.

India is endowed with vast reserves of rare earth elements, mineral salts, iron ore, bauxite, chromium, manganese ore, and baryte. With the introduction of the Mines and Minerals (Development and Regulation) Amendment Act 2021 and the National Mineral Policy 2019, India offers significant potential for investors seeking to participate in the country's metal industry. In the coming years, the Indian metals and mining industry is anticipated to undergo significant transformation due to initiatives like the Made in India Campaign, Smart Cities, Rural Electrification, and the National Electricity Policy's emphasis on developing renewable energy projects along with increased infrastructure development.

Table 7: Number of Reporting Mines

Sector	FY20	FY21	FY22	FY23(P)*	FY24(P)*
Metallic minerals	602	608	545	817	795
Non-metallic minerals	783	767	774	1253	1241

All Minerals (Total)	**1,385**	**1,375**	**1,319**	**2070**	**2036**

Source: Ministry of Mines website accessed on Dec 18, 2024
Note: (P) stands for provisional figures

In 2023-24, among the 2,036 reporting mines, Madhya Pradesh accounted for the highest number with 394 mines, followed by Gujarat with 291 mines, Andhra Pradesh with 182 mines, Tamil Nadu with 222 mines, Karnataka with 177 mines, Odisha with 147 mines, Chhattisgarh with 139 mines, Rajasthan with 113 mines, Maharashtra with 110 mines, and Jharkhand with 67 mines.

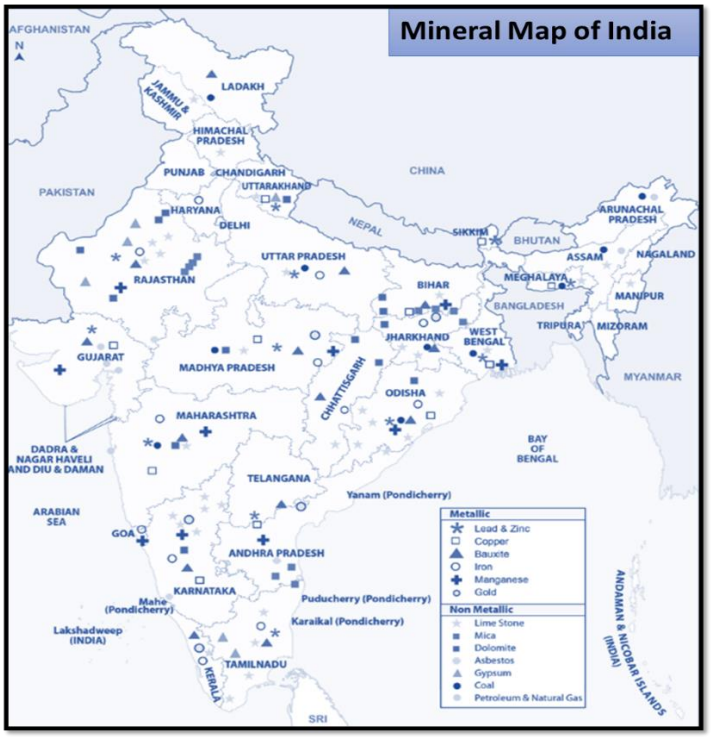
Table 8: Production of Principal Minerals & Metals, 2024 (Million Tonnes)

Sector	Production Quantity
Metallic Minerals	425.8
Industrial Minerals	379.9
Total	805.7

Source: Ministry of Mines website accessed on Dec 18, 2024

As India moves toward renewable energy and electric vehicles, the country's need for essential minerals (copper, manganese, zinc, indium, lithium, cobalt, and rare earth elements) is anticipated to rise. The increasing need for renewable energy is expected to cause the demand for essential minerals to surge fourfold by 2040, according to the International Energy Agency. Modern technologies such as solar panels, wind turbines, transmission networks, batteries, mobiles, flat-screen monitors, electric vehicles (EVs), drones, jet engines, and satellites depend on critical minerals.

Chart 37 : Mineral Map of India



Source: Maps of India

Capex requirement in mining industry directly presents itself as a growth in the demand for Material handling and processing systems

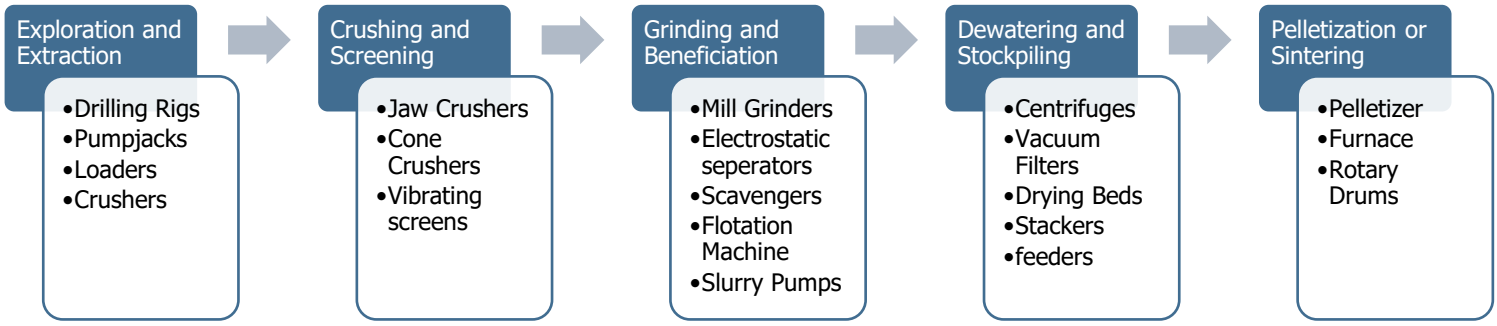
The increase in capital expenditure in the mining industry is closely tied to the expansion and upgrading of mining operations, which directly leads to a higher demand for material handling and material processing systems. As mining companies allocate more capital for growth and improvement, it typically results in the adoption of more advanced and scalable systems to handle the increased complexity of operations. Larger operations require more sophisticated material handling systems to move greater volumes of raw materials, ores, and waste. This translates into higher demand for conveyors, cranes, automated trucks, and rail transport.

For larger mines, especially those in remote areas, there is often a need for long-distance material transport systems, such as conveyor belts or rail systems. These systems are essential to move materials from extraction points to processing plants or storage facilities.

As part of capital investment, mining companies are moving toward automation to improve productivity and reduce labour costs. Systems such as automated conveyor systems etc. being adopted for material movement and processing tasks. This requires a substantial Capex investment, driving growth in the demand for more advanced material handling and processing technologies.

Increased capital expenditure enables the construction or expansion of processing plants. Larger plants require more robust and sophisticated material handling systems to manage higher volumes of ore, waste, and finished products. This includes systems such as crushing, milling, sorting, and smelting equipment that need to move materials seamlessly between various stages of processing. Mining companies will also invest in advanced processing technologies, such as flotation systems, chemical treatments, and ore sorting machines. These processes often require specialized material handling systems, such as wet handling systems, magnetic conveyors, and hydraulic transport systems, to ensure the efficient movement of materials through various stages. With more materials being extracted, companies must enhance their storage capacities, leading to a demand for automated storage and retrieval systems and palletizers to manage the increased inventory.

7.8 Material Processing in mining sector



In the mining sector, material processing refers to the various stages through which mined ore is transformed into usable products or concentrates. Each stage in the material processing process serves a specific purpose, such as breaking down materials, extracting valuable minerals, and preparing the product for shipment. Below is an explanation of each key stage in material processing:

1. Exploration and Extraction

Exploration is the initial phase in the mining process, where geologists and engineers search for ore deposits. Exploration activities may involve geological surveys, remote sensing, geophysical testing, and drilling to identify and map valuable mineral resources.

Extraction refers to the actual process of removing ore (minerals or metals) from the earth. This can be done through surface mining (open-pit mining) or underground mining (shaft or drift mining), depending on the depth and location of the ore body.

2. Crushing and Screening

Once the ore is extracted, it is often too large to process directly, so it is first subjected to crushing. Crushing involves breaking the ore into smaller, more manageable pieces. This is typically done using crushers such as jaw crushers, cone crushers, and impact crushers.

Screening follows crushing and involves sorting the crushed material based on particle size. This is done using vibrating screens or rotary screens to separate materials into smaller size fractions, which can then be further processed accordingly.

3. Grinding and Beneficiation

Grinding is the process of reducing the size of the crushed ore even further. This is typically done in mills, such as ball mills or rod mills, where the material is ground to a fine powder. The purpose of grinding is to liberate valuable minerals from the surrounding waste rock (gangue).

Beneficiation involves a series of processes designed to enhance the concentration of valuable minerals by separating them from the gangue (waste material). Beneficiation processes may include:

- **Flotation:** A chemical process used to separate valuable minerals from gangue by making the minerals hydrophobic (repelling water) so that they float to the surface and can be collected.
- **Magnetic Separation:** Uses magnets to remove magnetic minerals from the ore.
- **Gravity Separation:** Utilizes differences in density between minerals to separate them (e.g., using shaking tables or jigs).
- **Leaching:** A chemical process in which a solvent is used to dissolve valuable metals (such as gold or copper) from the ore.

4. Dewatering and Stockpiling

Dewatering is the process of removing water from the ore or concentrate. Water is often introduced during grinding, flotation, or other beneficiation processes. Excess water must be removed to improve the handling and transport of materials.

After dewatering, the processed materials are often stored in stockpiles. Stockpiling refers to the storage of concentrate or tailings at the mining site. Stockpiles allow for the controlled handling and shipment of the final product.

5. Pelletization or Sintering

Pelletization and Sintering are processes used to agglomerate fine particles into larger, more manageable forms. These processes are commonly used for iron ore processing but can also apply to other ores.

Pelletization involves compressing fine ore particles into small, round pellets using a pelletizing machine. The pellets are then heated in a furnace to harden them. The resulting pellets are easier to handle, and transport compared to fine ore.

Sintering is the process of fusing fine particles into larger agglomerates by heating them to elevated temperatures (but not melting them). This is done in a sintering furnace where the ore particles are mixed with a binder and heated to create a solid mass.

7.9 Trend across the country and relevant environmental policies driving demand

Environmental sustainability is a growing priority in India's manufacturing sector. The shift toward energy-efficient material handling systems, such as electric forklifts and automated conveyors, is driven by the need to reduce emissions. Key government policies influencing this trend include:

- National Action Plan on Climate Change (NAPCC): Promotes energy efficiency and renewable energy, encouraging industries to adopt eco-friendly material handling systems.
- Make in India and Atmanirbhar Bharat: These initiatives focus on self-reliance and industrial modernization, encouraging the adoption of automation and efficient systems to improve competitiveness.
- Energy Efficiency Improvements: The Bureau of Energy Efficiency's Perform, Achieve, and Trade (PAT) scheme incentivizes industries to enhance energy efficiency.
- Sustainable Transport Solutions: Government policies, such as the National Electric Mobility Mission Plan (NEMMP), encourage electric vehicle adoption in material handling and logistics, aiming to reduce emissions in warehouses and distribution centres.

7.10 Key Drivers and Challenges

Automation and Technological Advancements	Rapid developments in robotics, IoT-enabled systems, and AI are driving the adoption of material handling systems. These technologies enhance speed, accuracy, and efficiency, reducing labour costs and improving inventory control. Industries aiming for higher productivity and lower operational costs are increasingly adopting advanced solutions.
Growth of E-Commerce and Retail	The rise of e-commerce has increased the demand for efficient, automated material handling systems like sorting systems, conveyors, and robotic picking. These systems enable rapid order fulfilment and ensure timely deliveries, helping businesses meet customer expectations and handle high order volumes.
Need for Increased Efficiency and Productivity	Automation of repetitive tasks and optimization of supply chains are critical for reducing costs and improving productivity. Material handling systems support lean manufacturing and just-in-time inventory practices, ensuring smooth operations in warehouses and manufacturing facilities.
Safety and Compliance Regulations	Workplace safety and regulatory compliance are key drivers for adopting systems like automated forklifts and cranes. These systems reduce manual labour in hazardous tasks, minimizing accident risks and ensuring adherence to safety standards for handling dangerous materials.
Opening of New Mining Operations	India's expanding mining sector demands advanced systems such as automated conveyors, crushers, and stackers for efficient management of extracted materials. These systems

	enhance transportation, reduce operational costs, and support the sector's growth, particularly for minerals like coal and iron ore.
Environmental Regulations	Stringent regulations on air and water pollution, waste management, and land reclamation are driving investment in sustainable systems like water recycling facilities and low-emission crushers. The push for eco-friendly technologies ensures compliance with environmental standards and promotes efficient, sustainable material handling.

Challenges of Material Handling Systems

High Initial Investment Costs	Advanced material handling systems, including robotics and smart technologies, require significant capital investments, which can deter small and mid-sized companies despite long-term savings.
Integration with Existing Systems	Integrating new systems with legacy equipment and processes can be complex and costly. Compatibility issues may necessitate expensive upgrades, creating operational challenges in industries with fragmented supply chains.
Maintenance and Downtime	High-tech systems require regular maintenance, and breakdowns can lead to costly downtimes and operational disruptions. The need for skilled technicians adds to the cost and complexity of managing these systems.
Workforce Skill Gaps	The shift to automation and advanced technologies increases the need for skilled workers in areas like robotics and IoT. Training and upskilling the workforce are time-consuming and costly, posing a challenge for industries with traditionally low-tech workforces.

7.11 Key Government Initiatives

Initiatives	Details
Make in India Initiative	Launched in 2014, this initiative aims to transform India into a global manufacturing hub by encouraging production units in the country. It has driven demand for modern material handling equipment to streamline manufacturing processes and enhance productivity. Supported by programs like Production Linked Incentive (PLI) Schemes, PM Gati Shakti, National Logistics Policy, and GST reforms, it is a major driver of economic growth.
Infrastructure Development Plans	Initiatives like the National Infrastructure Pipeline (NIP) and Bharatmala Pariyojana are boosting demand for advanced material handling systems in construction, mining, and logistics. New highways, ports, and logistics hubs require automated material handling technologies for efficient transport, storage, and management.
Faster Adoption of Electric and Green Technologies	The government promotes green and sustainable technologies to reduce carbon emissions. Policies supporting electric vehicles (EVs) in material handling, such as electric forklifts and conveyors, drive the adoption of eco-friendly solutions. Incentives for energy-efficient systems reduce costs and environmental impact.

Initiatives	Details
Financial Incentives and Support for Manufacturing Equipment	Financial incentives and subsidies encourage companies to invest in advanced material handling systems. Schemes like the PLI program make it financially viable for businesses to adopt high-tech solutions, supporting the sector's growth.

8. Overview of Heavy Structural and Precision Engineering Industry

Heavy structural fabrication is the process of manufacturing large and complex structures from metal components, often involving the assembly of beams, columns, trusses, and other structural elements. These structures serve as the foundation for a wide range of industries, from construction and infrastructure to oil and gas, aerospace, and more.

8.1 Key Processes in Heavy Steel Fabrication:

1) **Design and Engineering:**

- **Blueprints and Specifications:** The fabrication process begins with detailed engineering drawings and blueprints, outlining the dimensions, materials, and assembly methods.
- **Structural Analysis:** Engineers conduct structural analysis to ensure the design meets safety standards and performance requirements.

2) **Material Selection:**

- **Steel Grades:** Different grades of steel are chosen based on the application, such as carbon steel for widespread use or alloy steel for specific strength requirements.
- **Quality Control:** Materials are inspected for defects and in compliance with industry standards before fabrication begins.

3) **Cutting and Shaping:**

- **Plasma Cutting:** Uses a high-temperature plasma arc to cut steel sheets and plates with precision.
- **Oxy-Acetylene Cutting:** Employs a combination of oxygen and acetylene gases to cut through thick steel.
- **Shearing and Punching:** Mechanical processes to cut or punch steel into required shapes.

4) **Welding and Joining:**

- **Arc Welding:** Uses an electric arc to melt and join steel pieces together. Common methods include MIG (Metal Inert Gas) and TIG (Tungsten Inert Gas) welding.
- **Submerged Arc Welding:** A high-productivity welding method where the arc is submerged under a layer of flux to protect it from contamination.

- **Pre-Fabrication:** Components are welded and assembled in sections before being transported to the construction site.

5) **Machining and Finishing:**

- **Drilling and Milling:** Precision machining processes to create holes, slots, and other features in steel components.
- **Grinding and Polishing:** Finishing processes to achieve smooth surfaces and remove imperfections.
- **Coating and Painting:** Protective coatings and paints are applied to prevent corrosion and enhance appearance.

6) **Assembly and Erection:**

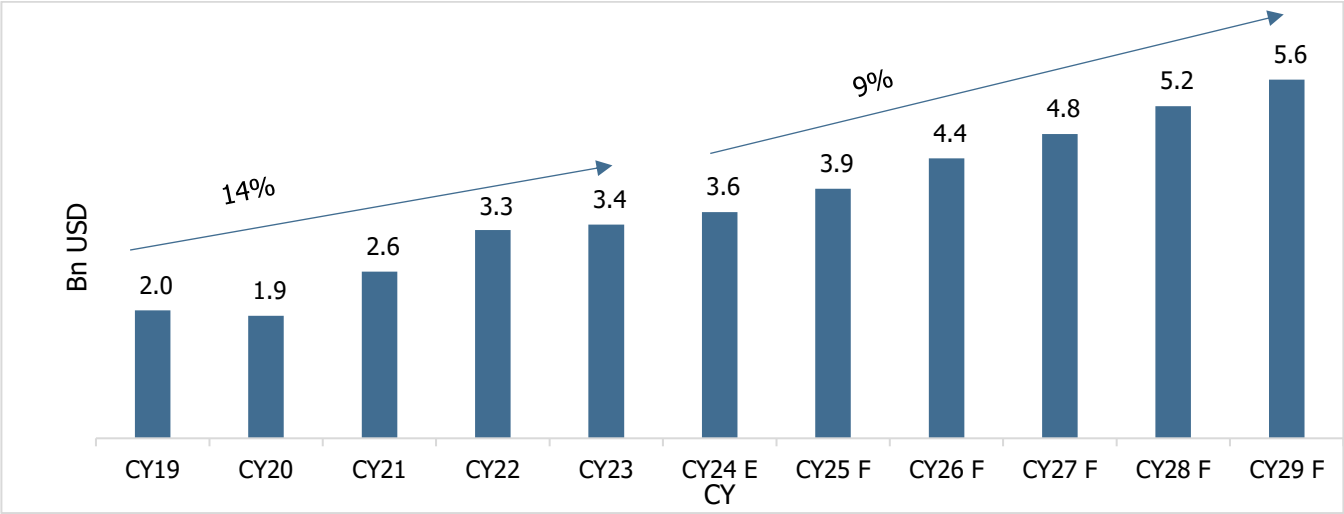
- **On-Site Assembly:** Large structures are assembled on-site using cranes and other heavy equipment.
- **Quality Checks:** Final inspections are conducted to ensure that the fabricated components meet design specifications and safety standards.

8.2 Applications of Heavy Steel Fabrication

Sector	Applications
Construction and Infrastructure	**Bridges**: Fabricated steel beams and trusses provide strength and durability. **High-Rise Buildings**: Structural steel frames support skyscrapers and high-rises. **Industrial Facilities**: Steel structures are fabricated to support heavy machinery in factories, warehouses, and processing plants.
Manufacturing and Machinery	**Heavy Machinery**: Fabrication of components for cranes, excavators, and other large machinery. **Industrial Equipment**: Production of large-scale equipment such as pressure vessels and storage tanks.
Energy Sector	**Power Plants**: Fabrication of steel structures for thermal, hydroelectric, and renewable energy plants. **Oil and Gas**: Steel components for drilling rigs, pipelines, and refineries.
Transportation	**Railways**: Steel fabrication for railway tracks, train stations, and rolling stock. **Ships and Marine**: Construction of steel hulls and structural components for ships and offshore platforms. **Aerospace**: Precision manufacturing for aircraft components and structures.

8.3 Trend in Heavy Structural and Precision Engineering Industry

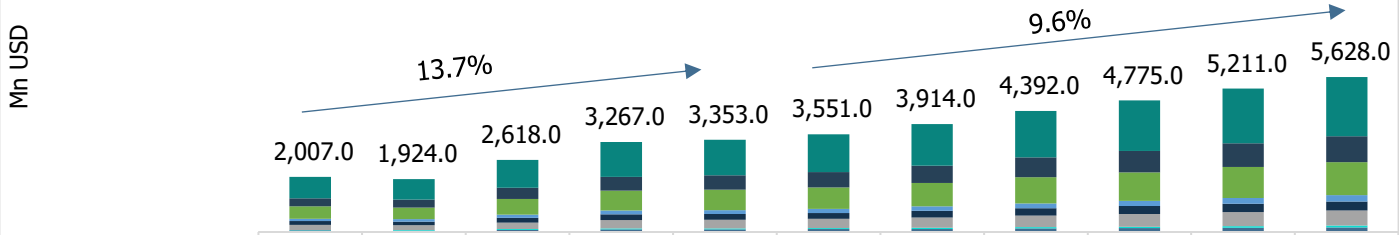
Chart 38: India Heavy Structural and Precision Engineering Market Size (USD Billion)



Source: MAIA Research

The India Heavy Structural and Precision Engineering market has shown significant fluctuations in recent years. In CY19, the market value was 2.0, but it slightly declined by 4.14% in CY20 to USD 1.9 Billion. However, the market rebounded strongly in CY21 with a growth rate of 36.07%, reaching a value of USD 2.6 Billion. This upward trend continued in CY22, with a 24.79% increase, bringing the market value to USD 3.3 Billion. By CY23, the market value further increased to 3.4 Billion, albeit with a modest growth rate of 2.63%. The heavy structural and precision engineering market is expected to grow at a CAGR of 9% from CY24 to CY29 to reach USD 5.6 Billion.

Chart 39: India Heavy Structural and Precision Engineering Market Value by End User CY19-CY29 (USD Million)



	CY19	CY20	CY21	CY22	CY23	CY24 E	CY25 F	CY26 F	CY27 F	CY28 F	CY29 F
Total	2,007.0	1,924.0	2,618.0	3,267.0	3,353.0	3,551.0	3,914.0	4,392.0	4,775.0	5,211.0	5,628.0
Others	778.0	746.0	1,013.0	1,264.0	1,294.0	1,370.0	1,507.0	1,687.0	1,831.0	1,992.0	2,146.0
Railways & Metro	298.0	290.0	400.0	506.0	526.0	563.0	628.0	712.0	782.0	862.0	942.0
Roads & Bridges	446.0	426.0	577.0	718.0	735.0	775.0	851.0	951.0	1,030.0	1,120.0	1,206.0
Dam Gates	91.0	86.0	114.0	140.0	142.0	148.0	161.0	178.0	192.0	208.0	222.0
Oil and Gas	135.0	127.0	169.0	207.0	211.0	218.0	238.0	264.0	284.0	306.0	327.0
Power and Energy	182.0	176.0	241.0	303.0	313.0	334.0	372.0	422.0	463.0	510.0	555.0
Aerospace	21.0	21.0	29.0	36.0	38.0	40.0	45.0	51.0	56.0	62.0	66.0
Defense	56.0	54.0	74.0	93.0	95.0	102.0	112.0	127.0	138.0	151.0	164.0

CY

Source: MAIA Research

The India Heavy Structural and Precision Engineering market has seen diverse growth across sectors. The defence sector grew at a CAGR of 14.1% from CY19 to CY23, with a forecasted 10.0% growth from CY24 to CY29. Aerospace experienced a 16.0% CAGR up to CY23 and is expected to grow at 10.5%. The power and energy segment had a CAGR of 14.5%, projected to grow at 10.7%.

The oil and gas sector grew at 11.8% CAGR, with an 8.4% forecasted growth. Dam gates also grew at 11.8%, with the same forecasted growth rate of 8.4%. Roads and bridges grew at 13.3% CAGR, with a forecast of 9.2%, while railways and metro systems had a strong CAGR of 15.3%, expected to grow at 10.8%.

The 'others' category, including smaller segments, grew at 13.6%, with a forecasted 9.4%. Overall, the market grew at 13.7% from CY19 to CY23 and is projected to grow at 9.6% from CY24 to CY29, reflecting steady expansion across all sectors.

8.4 Advantages and Challenges of Heavy Structural Fabrication

Heavy Structural Fabrication refers to the process of manufacturing large, load-bearing structures (such as beams, columns, trusses, and steel plates) for use in construction projects, particularly in industries like building construction, bridges, industrial plants, and infrastructure. The process involves the design, cutting, shaping, welding, and assembling of materials, often steel or reinforced concrete, to create components that can be assembled on-site.

- **Advantages-**

Advantages	Description
Precision and Customization	• **Tailored Components:** Fabrication allows to produce highly customized components tailored to the specific needs of the project, including unusual or complex designs. • **Accuracy:** The fabrication process involves advanced machinery (e.g., CNC machines, robotic welding) which ensures elevated levels of precision and consistency in components, reducing errors and improving the quality of the final structure.
Infrastructure Development	• **Critical Infrastructure:** Heavy structural construction is essential for the development of roads, bridges, ports, airports, and other key infrastructure. These projects are the backbone of national and regional economies. • **Urbanization and Growth:** Structural projects, such as high-rise buildings, commercial centres, and industrial complexes, are vital in accommodating growing populations and expanding economies.
Technological Advancements	• **Innovative Designs and Materials**: The heavy structural industry often leads the way in developing new construction techniques, materials, and technologies, such as high-strength steel, prefabrication, and advanced robotics. • **Sustainability and Efficiency:** Increasing emphasis is placed on eco-friendly building materials, energy-efficient designs, and reducing carbon footprints, which contribute to sustainable development.
Long-Term Durability	• **Longevity of Structures:** Heavy structural works, such as bridges, dams, and factories, are built to last for decades, providing a long-term return on investment and serving critical functions for years
High-Precision Work	• **Precision Engineering:** Heavy structural projects require elevated levels of precision, which results in the development of highly skilled engineers, designers, and craftsmen, contributing to knowledge transfer and skill development in the workforce.

- **Challenges-**

Challenges	Description
High Initial Capital Investment	• **Expensive Equipment:** Heavy structural fabrication requires significant investment in advanced machinery, tools, and technologies, including welding machines, CNC equipment, and quality control systems. These costs can be a barrier for smaller companies or for businesses starting in the sector. • **Facility Setup:** The need for large-scale workshops or fabrication plants adds to the upfront costs. In addition, the space required for storing raw materials and fabricated parts can be costly.
Supply Chain and Material Costs	• **Material Availability:** Heavy structural fabrication depends heavily on the availability of raw materials, particularly high-strength steel, aluminium, and other metals. Supply chain disruptions (e.g., price fluctuations, shipping delays, or geopolitical issues) can lead to increased costs or delays in production. • **Material Handling and Storage**: Managing enormous quantities of heavy materials requires significant storage space and efficient handling systems, which can increase operational complexity and costs.
Complexity in Project Management	• **Coordination:** Fabrication projects involve coordination between design teams, engineers, suppliers, and fabricators. Managing schedules, material flows, and quality control across multiple parties can be complex. • **Design Changes**: Changes to design specifications, either during the fabrication phase or after the components are delivered, can lead to costly delays, rework, and potential material wastage.
Environmental Impact	• **Energy Consumption:** The fabrication of heavy structures, especially in the steel industry, is energy-intensive. This contributes to a large carbon footprint, particularly if energy is sourced from non-renewable sources. • **Waste Management:** While fabrication may reduce waste compared to on-site construction, the process still generates scrap materials, which need to be recycled or disposed of properly to minimize environmental impact.

9. Overview of Electrical Contracting in India

9.1 Overview of electrical contracting landscape in India

India is the third largest producer and the second largest consumer of electricity in the world. Consumer electrical industry is one of the important aspects of the Indian economy, contributing approximately 8% to the country's manufacturing production, approximately 1.5% to India's GDP and approximately 1.5% to India's exports.

Major growth drivers include increasing demand for electricity, the rise of smart cities, industrial modernization, renewable energy integration, and government initiatives like "Make in India" and "Smart Cities Mission." Moreover, the government's push for infrastructure development and large-scale construction projects (such as highways, airports, metro systems) is a key factor propelling the demand for electrical contractors.

Key market segments-

Sector	Description
Residential	Electrical contractors manage wiring, lighting systems, and the installation of safety equipment, such as circuit breakers and energy meters, in residential construction.
Commercial	Provide electrical services for office buildings, retail spaces, and other commercial developments, focusing on sophisticated and energy-efficient systems.
Industrial	Specialize in electrical infrastructure and maintenance for factories, manufacturing plants, and industrial zones, including high-voltage and automated systems.
Infrastructure & Large Projects	Handle electrical systems for airports, railways, metro systems, highways, power plants, and water treatment plants, ensuring safety standards and integrating renewable energy solutions.

The electrical contracting industry in India is governed by several regulations and standards, including the Indian Electricity Act, 2003**,** the Indian Standards (IS)**,** and the National Electric Code (NEC). These regulations set the framework for electrical safety, installations, and maintenance practices.

9.2 Regulatory framework and compliance requirement for A-1 contractors

In India, electrical contractors, especially those with A-1 classification, must adhere to a variety of regulatory and compliance requirements to operate legally and ensure the safety and quality of their work. The **A-1** classification refers to the highest category of electrical contractors under various state-level and national-level licensing and registration systems. This classification typically indicates that the contractor is authorized to undertake high-value and complex electrical works, including industrial, commercial, and infrastructure projects.

Indian Electricity Act, 2003

The Indian Electricity Act, 2003 is the primary legislation governing the generation, transmission, distribution, and use of electricity in India. The act covers:

- **Licensing Requirements**: Contractors must comply with licensing requirements stipulated by the Central Electricity Authority (CEA) and respective State Electricity Regulatory Commissions (SERCs) to work on high-voltage systems and major electrical infrastructure projects.
- **Electrical Safety**: The act mandates adherence to safety standards, precautions, and practices during the installation, operation, and maintenance of electrical systems to avoid accidents, electrical fires, and damage to equipment.
- **Certification of Electrical Installations**: Any electrical installation above a certain voltage level (e.g., 415V or 650V) must be certified by a licensed electrical contractor.

Central Electricity Authority (CEA) Regulations

The Central Electricity Authority issues regulations that electrical contractors must follow, particularly when working on electrical installations above 650V or in critical infrastructure. Key regulations include:

- **Indian Electricity Rules, 1956**: Specifies the safety and technical standards that electrical contractors must adhere to when working on electrical systems, including the installation of electrical wiring, earthing, and protection devices.
- **Regulations for Grid Connectivity**: Contractors involved in renewable energy (e.g., solar or wind) installations or power generation projects must comply with the CEA's grid connection requirements.
- **Technical Standards for Electrical Installations**: These include technical guidelines and best practices for the installation and maintenance of electrical systems in compliance with national standards (e.g., IS 732 for wiring).

State Electricity Rules and Licensing Requirements

Each state in India has its own Electricity Regulatory Commission (SERC) that implements and monitors compliance with the Indian Electricity Act, 2003, as well as issues state-specific regulations. A-1 contractors must comply with the following at the state level:

- **Electrical Contractors License**: Contractors must obtain an A-1 or equivalent classification from the State Licensing Board, which certifies them to work on high-value and complex electrical installations.
- **Renewal of License**: Electrical contractors must renew their licenses periodically (e.g., every 3-5 years) and ensure compliance with continuing education and safety updates.

National Standards and Codes of Practice

Contractors must follow national standards and codes of practice established by Bureau of Indian Standards (BIS) and other national bodies, such as the National Building Code (NBC)**.** Some of the important standards include:

Standard	**Description**
IS 732	Code of practice for electrical wiring installations.
IS 3043	Code of practice for earthing.

Standard	Description
IS 375	Code of practice for the installation of electrical appliances.
IS 5216	Code of practice for safety of electrical installations.
National Building Code of India	Includes electrical safety standards for residential and commercial building construction.

License & Registration for Electrical Contractors

- **A-1 Classification**: The classification is generally based on criteria such as:
  - Minimum number of years of experience in the electrical contracting industry (typically 10-15 years).
  - Technical qualification and certification of the key personnel (e.g., licensed electricians, engineers).
  - Financial capability and infrastructure to undertake large-scale projects.
- **Required Documents**: The contractor must submit documents like proof of experience, financial statements, technical qualifications, and business registration documents (e.g., GST registration, PAN card, etc.) to get the A-1 license.

9.3 Importance of substations and electrical infrastructure in regional development

Substations and electrical infrastructure are fundamental components of regional development, playing a critical role in enabling economic growth, improving quality of life, and supporting industrialization. Reliable and efficient electrical systems are the backbone of urban, rural, and industrial development, affecting everything from residential power supply to large-scale infrastructure projects.

1. Reliable Power Supply for Industrial Growth

- **Supporting Industries**: A stable and reliable power supply is a key requirement for industries such as steel, cement, textiles, pharmaceuticals, and chemicals, which rely heavily on electricity for production processes.
- **Facilitating Industrialization**: Regions with inadequate power supply face limitations in industrial expansion, as companies often require uninterrupted power to maintain production schedules and minimize downtime.

2. Promoting Urbanization and Infrastructure Development

- **Urban Growth**: Substations and electrical grids are vital for the expansion of urban areas. As cities grow, the demand for power increases across residential, commercial, and public sectors.
- **Smart Cities**: In modern urban planning, electrical infrastructure plays a crucial role in developing smart cities, where digital technologies are integrated with power management to optimize resources, improve sustainability, and enhance the quality of urban life.

3. Economic Development and Investment

- **Attracting Investment**: Regions with reliable and modern electrical infrastructure are more likely to attract investment.
- **Boosting Local Economy**: Electrical infrastructure supports local businesses, enabling them to operate efficiently, reduce operational costs, and increase productivity.

4. Improving Quality of Life

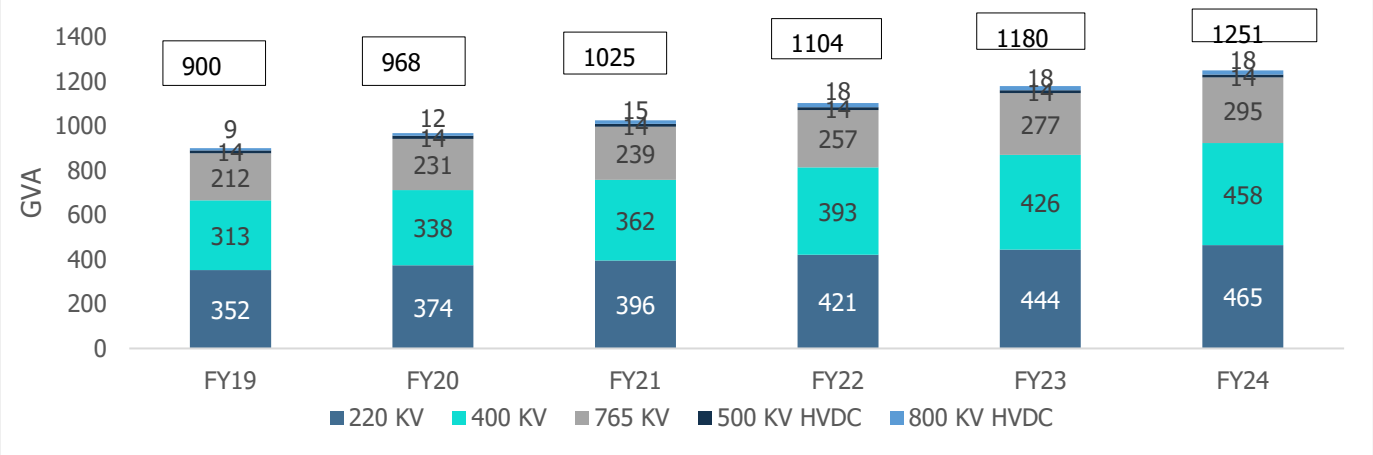
- **Residential Power Supply**: Reliable electricity is essential for improving living standards, providing access to modern appliances, and enhancing overall quality of life in both urban and rural areas.
- **Healthcare, Education, and Public Services**: Power supply is essential for hospitals, schools, government offices, and other public services.
- **Rural Electrification**: In rural areas, electrical infrastructure is crucial for reducing the urban-rural divide. Electrification brings opportunities such as better healthcare, education, access to information (via the internet), and improved agricultural practices (e.g., irrigation, cold storage).

5. Support for Digital Infrastructure

- **Connectivity and Technology**: Modern electrical infrastructure supports the digital backbone of a region, which is essential for IT parks, data centres, and telecommunications.
- **Data Centres and Cloud Infrastructure**: Data centres, which require massive amounts of uninterrupted power, are a crucial part of regional economic development.

9.3.1 Trend in Substation in India (FY19 to FY24)

Chart 40: Transformation Capacity (220 kV & Above)



Source: Central Electricity Authority, CareEdge Research

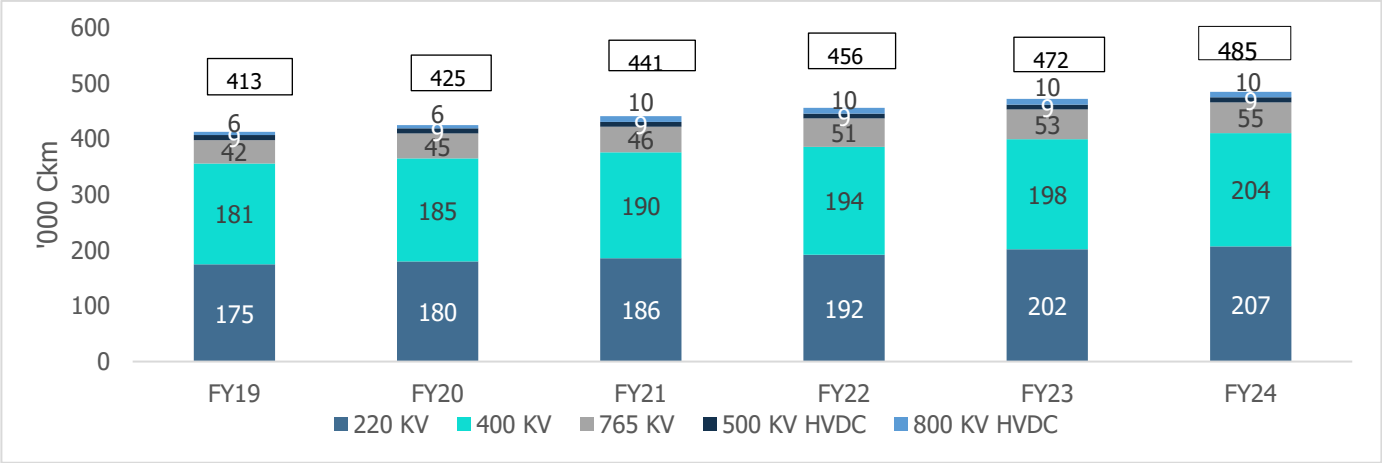
India aims to achieve 500 GW of renewable energy capacity by 2030. As of July 2024, there are 54 transmission projects constructed, and 53 projects are under construction. These include various projects of transmission systems associated with renewable projects and conventional projects in Rajasthan, Karnataka, Maharashtra, etc. These projects are being executed mainly by PGCIL along with private players like Sterlite Power Transmission Limited, Adani Transmission

Limited, ReNew Transmission Ventures Private Limited, etc. Furthermore, the substation line network grew at a CAGR of approximately 7% to 1.25 million MVA as of March 2024 from 0.8 million MVA as of March 2019.

9.3.2 Trend in Transmission lines in India (FY19 to FY24)

The transmission line network grew at a CAGR of approximately 3% to 4,85,544 CKm as of March 2024 from 4,13,407 CKm as of March 2019. During FY24, 14,203 CKm of transmission lines were added to the total network. The transmission line network stood at 4,87,587 CKm as of July 2024. Whereas the transformation line capacity is at 12,65,700 MVA as of July 2024.

Chart 41: Transmission Line Network (220 kV & Above)

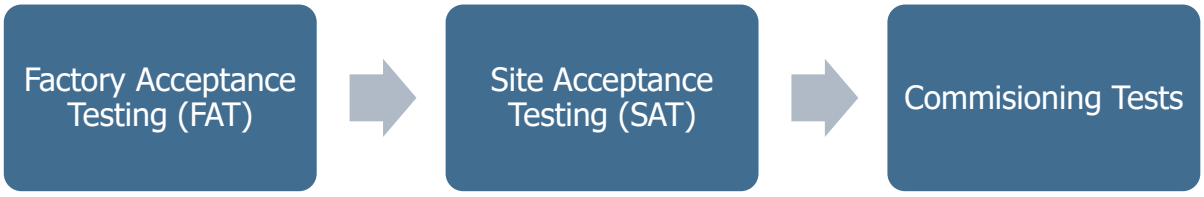


Source: Central Electricity Authority, CareEdge Research

9.4 Overview of Testing and Commissioning of Electrical Equipment in India

Testing and commissioning of electrical equipment in India is a crucial process to ensure the safe, reliable, and efficient operation of electrical systems. It involves multiple phases, starting with Factory Acceptance Testing (FAT) to verify equipment compliance with design specifications, followed by Site Acceptance Testing (SAT) to check installation quality on-site. The commissioning tests ensure that all systems are functioning properly under actual operating conditions, while performance testing assesses the system's stability and efficiency. The process also includes final checks, training, and the handover of detailed documentation. Key equipment tested includes transformers, switchgear, cables, motors, control systems, and protection devices, adhering to national standards like IS 3043, IS 375, and IEC standards. Emerging trends include the integration of smart grid technologies, renewable energy systems, and digital tools for more efficient testing and predictive maintenance. This comprehensive approach ensures that electrical systems meet safety, regulatory, and operational standards, contributing to the country's growing energy infrastructure.

Figure 4: Key Phases of Testing and Commissioning



Source: CareEdge Research

10. Key Threats and Challenges

The engineered building sector faces the following key threats and challenges that can impact its growth and sustainability.

Challenge	Description
Rising Cost of Raw Materials	Fluctuating and increasing costs of essential raw materials like steel, cement, timber, and glass significantly impact project budgets. Contributing factors include global supply-demand imbalances, inflation, and increased energy costs. Price volatility can lead to unforeseen financial strains, project delays, or cost-cutting measures that may compromise quality.
Supply Chain Disruptions	The sector relies on a global supply chain for materials, equipment, and skilled labour. Disruptions caused by geopolitical issues, trade restrictions, natural disasters, or health crises like COVID-19 can halt projects, delay timelines, and increase costs. Shortages force reliance on alternative suppliers at higher costs, creating uncertainty and requiring robust risk management strategies.
Stringent Environmental Regulations	Growing sustainability focus demands compliance with stricter environmental regulations, including energy efficiency standards, reduced carbon emissions, and sustainable materials. Compliance often leads to higher upfront costs and investment in innovative technologies and eco-friendly designs. Smaller contractors face financial burdens achieving certifications like LEED or BREEAM.
Labour Shortages and Skills Gap	A shortage of skilled labour, driven by an aging workforce and a lack of young entrants in trades, hampers productivity, increases errors, and raises labour costs. Specialized skills for modern engineered buildings, such as advanced materials and digital tools, are in high demand. Bridging this gap requires costly training and recruitment efforts, further burdening contractors.
Complexity of Building Designs	Increasing demand for innovative, high-performance buildings results in more complex designs requiring advanced technologies like smart systems and sustainable solutions. Frequent revisions and customization demand add to challenges. Strong project management and collaboration among stakeholders are essential to avoid delays, cost overruns, and structural issues.

11. Peer Comparison

Company Profiling

Ardee Engineering Limited

Ardee Engineering Limited is an Indian company incorporated in 2008, specializes in the design, engineering, manufacturing, and supply of high-quality engineering products and solutions. With a focus on providing customized engineering and innovative solutions, Ardee Engineering serves various sectors including mining, process industries, infrastructure, and industrial applications. The company is known for its expertise in offering products such as steel structures, pre-fabricated buildings, Material Handling and Processing system solutions and custom-engineered solutions. With a strong emphasis on quality, reliability, and customer satisfaction, Ardee Engineering has built a solid reputation in the engineering and construction industries. The company's commitment to technological advancements and sustainability further enhances its position in the market.

Ardee Engineering Limited is the fastest growing integrated design, engineering and manufacturing company based on revenue CAGR between FY22 and FY24, among peers considered, with a focus on PEB and MHS. The growing PEB and MHS industries positively impact us by creating increased demand for the wide range of services and offering significant growth potential. The PEB market is projected to grow at a CAGR of 13% from FY24 to FY29 with the highest growth anticipated in warehouses, cold storage, and data centres.

They have a strong track record of executing various complex, challenging engineering projects within India. In the aerospace sector, Ardee supplied three mobile launch pedestals for the PIF project of SDSC SAHR -ISRO at Sriharikota. Some of the details are given below-

Name and Description of the project	Features
Launch Pad of PSLV Integration Facilities ("PIF") Project of Satish Dhawan Space Centre, Sriharikota, Indian Space Research Organisation ("SDSC SAHR- ISRO")	Executed the Supply, Manufacturing, Transportation and Erection of the Mobile Launch Pedestals ("MLP"). Each of these MLPs weigh approximately 245 tons.

Table 9: KPIs of Ardee Engineering Limited (Rs. Million)

Ardee Engineering Limited	FY22	FY23	FY24	H1FY25
Revenue from operations	2,168.64	3,312.52	6,209.90	2,882.82
Order Book	3,176.32	5,828.31	7,218.00	7,612.81
EBITDA	90.96	248.59	606.49	350.59
PAT	12.86	109.13	291.05	155.97
Net Debt	712.58	725.75	1,605.71	1,654.82
Total Equity	120.78	331.31	873.11	1,030.97
Ratios				
EBITDA Margin	4.18%	7.49%	9.74%	12.11%
PAT Margin	0.59%	3.29%	4.67%	5.39%
Return on Equity	10.65%	32.94%	33.33%	15.13%
ROCE (New)	7.80%	16.16%	20.97%	11.04%
Net Debt/ EBITDA	7.83	2.92	2.65	4.72
Net Debt / Total Equity	5.90	2.19	1.84	1.61

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Pre-engineered building	1,556.62	1,353.83	3,111.75	1,447.20
Material handling systems	329.35	1,508.47	1,221.21	705.41
Engineering Services	282.67	444.1	1,872.11	711.9
Other	0	6.12	4.83	18.31
Total Revenue	**2,168.64**	**3 ,312.52**	**6,209.90**	**2,882.82**

Source: Company Annual Reports, CareEdge Research

- **Peers for Pre- Engineering Buildings**

Interarch Building Products Private Limited

Interarch Building Products Private Limited is an Indian company incorporated in 1983 specializes in the design, manufacturing, and supply of high-quality building products, particularly in the pre-engineered building (PEB) sector. The company offers a range of solutions, including steel structures, roofing systems, and insulation products, catering to a wide array of industries such as manufacturing, warehousing, and commercial infrastructure. Known for its innovative and sustainable building solutions, Interarch is committed to delivering cost-effective and durable structures.

Table 10: KPIs of Interarch Building Products Private Limited (Rs. Million)

Interarch Building Products Private Limited	FY22	FY23	FY24	H1FY25
Revenue from operations	8,349.42	11,239.26	12,933.02	6,267.00
Order Book	NA	NA	NA	NA
EBITDA	388.04	1,188.45	1,260.28	602.08
PAT	171.34	814.62	862.62	409.50
Net Debt	-870.43	-1,021.48	-1,261.38	-3,656.54
Total Equity	3,183.19	3,992.79	4,446.25	6,763.58
Ratios				
EBITDA Margin	4.61%	10.46%	9.65%	9.49%
PAT Margin	2.04%	7.17%	6.60%	6.45%
Return on Equity	5.38%	20.40%	19.40%	6.05%
ROCE (New)	8.35%	26.78%	25.64%	8.00%
Net Debt/ EBITDA	-2.24	-0.86	-1.00	-6.07
Net Debt / Total Equity	-0.27	-0.26	-0.28	-0.54

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Building Materials	937.57	1204.34	2,974.96	NA
Pre-engineered building	7,213.41	9861.368	9,785.87	NA
Others	198.45	173.552	172.19	NA
Total Revenue	8,349.42	11239.26	12,933.02	NA

Source: Company Annual Reports, CareEdge Research

JSW Severfield Structures Limited (JSSL)

JSW Severfield Structures Limited (JSSL) is a joint venture between JSW Steel Limited and Severfield (UK) Limited, specializing in the design, fabrication, and erection of steel structures. Based in India, JSSL provides comprehensive solutions for a variety of industries, including infrastructure, industrial, and commercial construction. The company is renowned for its high-quality steel products, innovative design capabilities, and expertise in executing large-scale projects and high-rise structures.

Table 11: KPIs of JSW Severfield Structures Limited (JSSL) (Rs. Million)

JSW Severfield Structures Limited (JSSL)	FY22	FY23	FY24	H1FY25
Revenue from operations	10,438.31	13,839.25	13,515.11	NA
Order Book	NA	NA	NA	NA
EBITDA	823.85	1,200.74	1,302.53	NA
PAT	201.92	318.33	330.32	NA
Net Debt	1,479.99	2,528.86	867.56	NA
Total Equity	3,353.20	3,673.47	4,565.35	NA
Ratios				
EBITDA Margin	7.87%	8.65%	9.57%	NA
PAT Margin	1.93%	2.30%	2.44%	NA
Return on Equity	6.02%	8.67%	7.24%	NA
ROCE (New)	12.72%	14.97%	18.41%	NA
Net Debt/ EBITDA	1.39	1.94	-0.02	NA
Net Debt / Total Equity	0.34	0.63	-0.01	NA

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Revenue from sale of products and services	10,066.05	13,433.65	13,192.77	NA
Other operating revenues	372.25	405.60	322.34	NA
Total revenue	10,438.31	13,839.25	13,515.11	NA

Source: Company Annual Reports, CareEdge Research

Pennar Industries Limited

Pennar Industries Limited is an Indian manufacturing company incorporated in 1988, specializes in the production of high-quality engineered products and solutions. The company operates across diverse sectors including automotive, infrastructure, energy, and construction, offering a wide range of products such as precision steel components, cold-rolled steel, and structural products. Pennar Industries is known for its technological innovation, advanced manufacturing processes, and commitment to quality, serving both domestic and international markets.

Table 12: KPIs of Pennar Industries Limited (Rs. Million)

Pennar Industries Limited	FY22	FY23	FY24	H1FY25
Revenue from operations	22,657.50	28,946.20	31,305.70	14,810.60
Order Book	4,407.60	8,000+	8,100.00	8,400.00
EBITDA	1,884.20	2,546.20	3,132.80	1,601.90
PAT	419.10	754.30	983.50	532.70
Net Debt	5,469.20	4,938.90	6,234.80	6,951.80
Total Equity	7,361.30	7,789.80	8,774.70	9,319.30
Ratios				
EBITDA Margin	8.25%	8.70%	9.88%	10.72%
PAT Margin	1.84%	2.58%	3.10%	3.56%
Return on Equity	5.69%	9.68%	11.21%	5.72%
ROCE (New)	10.19%	13.60%	15.38%	7.31%
Net Debt/ EBITDA	2.90	1.94	1.99	4.34
Net Debt / Total Equity	0.74	0.63	0.71	0.75

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Diversified engineering	13,552.10	15112.90	16,413.70	NA
Custom designed building solutions & auxiliaries	10,446.20	15050.10	15,839.10	NA
Less: Inter segment revenue	1,340.80	1216.80	947.10	NA
Total Revenue	22,657.50	28946.20	31,305.70	NA

Source: Company Annual Reports, CareEdge Research

Everest Industries Limited

Everest Industries Limited is a leading Indian company incorporated in 1934, specializes in manufacturing and providing innovative building products and solutions. Known for its expertise in roofing and pre-engineered buildings, Everest offers a wide range of construction materials, including fibre cement sheets, insulation products, and other building solutions. The company serves various industries, including residential, industrial, and commercial sectors, focusing on delivering high-quality, cost-effective, and eco-friendly products.

Table 13: KPIs of Everest Industries Limited (Rs. Million)

Everest Industries Limited	FY22	FY23	FY24	H1FY25
Revenue	13,647.06	16,476.34	15,754.52	8,991.59
Order Book	NA	NA	NA	NA
EBITDA	983.05	1,081.15	663.03	358.72
PAT	440.85	423.60	179.98	42.32

Net Debt	-1,105.06	986.80	321.69	2,795.28
Total Equity	5,422.95	5,814.56	5,974.14	6,021.49
Ratios				
EBITDA Margin	7.05%	6.40%	4.16%	3.96%
PAT Margin	3.16%	2.51%	1.13%	0.47%
Return on Equity	8.13%	7.29%	3.01%	0.70%
ROCE (New)	12.27%	11.11%	5.11%	2.17%
Net Debt/ EBITDA	-1.12	0.91	0.49	7.79
Net Debt / Total Equity	-0.20	0.17	0.05	0.46

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Building products	10,452.07	11,384.52	11,542.06	NA
Steel buildings	3,194.99	5,091.82	4,212.46	NA
Total Revenue	13,647.06	16,476.34	15,754.52	NA

Source: Company Annual Reports, CareEdge Research

- **Peers for Material Handling**

Macmet Engineering Limited

Macmet Engineering Limited, incorporated in 1974, is a leading Indian company specializing in the design, engineering, and manufacture of material handling systems and water infrastructure projects. It is renowned for its expertise in supplying overland belt conveyors, pipe conveyors, and other advanced bulk material handling solutions for industries such as power, steel, cement, and mining.

Table 14: KPIs of Macmet Engineering Limited (Rs. Million)

Macmet Engineering Limited	FY22	FY23	FY24	H1FY25
Revenue	3,378.98	4,023.80	4,182.64	NA
Order Book	NA	NA	NA	NA
EBITDA	250.79	336.80	249.83	NA
PAT	130.36	196.14	95.28	NA
Net Debt	362.26	430.03	601.20	NA
Total Equity	921.31	1,109.63	1,197.09	NA
Ratios				
EBITDA Margin	7.40%	8.33%	5.96%	NA
PAT Margin	3.86%	4.87%	2.28%	NA
Return on Equity	14.15%	17.68%	7.96%	NA
ROCE (New)	18.09%	20.61%	12.68%	NA
Net Debt/ EBITDA	0.27	0.35	0.66	NA
Net Debt / Total Equity	0.07	0.11	0.14	NA

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million) -

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Revenue from sale of products and services	3,322.25	4,021.77	4,176.02	NA
Other operating revenues	56.74	2.04	6.62	NA
Total Revenue	3,378.98	4,023.80	4,182.64	NA

Source: Company Annual Reports, CareEdge Research

- **Peers for EPC Players**

Capacite Infraprojects Limited

Capacite Infraprojects Limited was established in 2012 and is primarily engaged in the EPC business and provides turnkey solutions for housing, high rises, super high rises, speciality buildings and urban infrastructure. The company offers these services to leading real-estate and government bodies in India.

Table 15: KPIs of Capacite Infraprojects Limited (Rs. Million)

Capacite Infraprojects Limited	FY22	FY23	FY24	H1FY25
Revenue	13,398.28	17,985.87	19,316.38	10,877.22
Order Book	87,020.00	95,130.00	90,110.00	92,030.00
EBITDA	2,309.29	3,613.76	3,643.74	2,183.75
PAT	477.57	952.97	1,203.30	983.68
Net Debt	1,354.41	1,791.13	1,016.00	1,924.05
Total Equity	9,651.74	10,734.52	15,170.75	16,143.71
Ratios				
EBITDA Margin	17.07%	19.99%	18.56%	19.82%
PAT Margin	3.53%	5.27%	6.13%	8.93%
Return on Equity	4.95%	8.88%	7.93%	6.09%
ROCE (New)	9.97%	15.11%	13.83%	8.64%
Net Debt/ EBITDA	0.59	0.50	0.28	0.88
Net Debt / Total Equity	0.14	0.17	0.07	0.12

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Construction contract revenue	13,267.25	17,835.09	19,070.58	NA
Sale of material	NA	NA	117.62	NA
Others	131.04	150.78	128.19	NA
Total Revenue	13,398.28	17,985.87	19,316.38	NA

Source: Company Annual Reports, CareEdge Research

PSP Projects Limited

PSP Projects Limited is an Indian construction and engineering company established in 2008. It specializes in providing a wide range of services including civil construction, project management, and development services, primarily in the infrastructure and real estate sectors. The company has built a strong reputation for executing large-scale commercial, residential, and institutional projects.

Table 16: KPIs of PSP Projects Limited (Rs. Million)

PSP Projects Limited	FY22	FY23	FY24	H1FY25
Revenue	17,480.63	19,378.06	25,057.89	12,090.28
Order Book	43,240.00	50,520.00	60,490.00	65,460.00
EBITDA	2,805.33	2,523.65	2,846.67	1,199.10
PAT	1,666.52	1,319.41	1,229.73	448.96
Net Debt	-2,389.89	-1,956.67	1,869.13	-55.52
Total Equity	6,869.59	8,009.93	9,148.70	11,976.00
Ratios				
EBITDA Margin	15.85%	12.86%	11.25%	9.85%
PAT Margin	9.42%	6.72%	4.86%	3.69%
Return on Equity	24.26%	16.47%	13.44%	3.75%
ROCE (New)	31.64%	22.48%	16.06%	5.80%
Net Debt/ EBITDA	-0.85	-0.78	0.66	-0.05
Net Debt / Total Equity	-0.35	-0.24	0.20	0.00

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Revenue from Contracts with Customers	17,361.85	19,252.25	24,879.37	NA
Other Operating Revenue	118.78	125.81	178.51	NA
Total Revenue	17,480.63	19,378.06	25,057.89	NA

Source: Company Annual Reports, CareEdge Research

Ahluwalia Contracts (India) Limited

Ahluwalia Contracts (India) Limited, established in 1965, is a prominent Indian engineering, procurement, and construction (EPC) company headquartered in New Delhi. The company specializes in civil construction activities, focusing on the development of residential and commercial complexes, information technology parks, institutional buildings, hospitals, corporate offices, metro stations, industrial townships, and urban infrastructure projects.

Table 17: KPIs of Ahluwalia Contracts (India) Limited (Rs. Million)

Ahluwalia Contracts (India) Limited	FY22	FY23	FY24	H1FY25
Revenue	26,924.69	28,383.93	38,552.98	19,308.29
Order Book	1,30,336.10	1,39,306.70	1,70,102.40	2,48,698.00
EBITDA	2,857.02	3,335.06	6,194.41	1,565.85
PAT	1,552.17	1,939.77	3,748.26	692.37
Net Debt	-3,984.21	-5,910.72	-7,319.02	-6,912.16
Total Equity	10,351.85	12,283.32	15,999.45	16,655.66
Ratios				
EBITDA Margin	10.50%	11.63%	15.92%	8.02%
PAT Margin	5.70%	6.76%	9.63%	3.54%
Return on Equity	14.99%	15.79%	23.43%	4.16%

ROCE (New)	24.37%	23.96%	33.62%	7.46%
Net Debt/ EBITDA	-1.39	-1.77	-1.18	-4.41
Net Debt / Total Equity	-0.38	-0.48	-0.46	-0.42

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Construction Contract*	26,850.62	28,325.28	38,481.78	NA
Lease Rental	33.80	58.66	64.04	NA
Others	40.28	NA	7.16	NA
Total Revenue	26,924.69	28,383.93	38,552.98	NA

Source: Company Annual Reports, CareEdge Research

ISGEC Heavy Engineering

ISGEC Heavy Engineering was established in 1933 is one of the oldest manufacturing and testing facilities in India. They are into various businesses like EPC, Process equipment manufacturing, steel and Iron castings, etc. They have their headquarters in Noida, Delhi. They have installed a number if plants for Power, Coal, oil on EPC basis over the years.

Table 18: KPIs of ISGEC Heavy Engineering (Rs. Million)

ISGEC Heavy Engineering Limited	FY22	FY23	FY24	H1FY25
Revenue	54,993.43	63,990.39	62,193.37	31,835.80
Order Book	73,220.00	83,210.00	79,050.00	70,660.00
EBITDA	3,246.17	4,673.18	5,240.79	2,962.90
PAT	1,149.85	2,055.41	2,548.72	1,628.70
Net Debt	10,967.27	10,245.34	6,141.34	5,415.20
Total Equity	22,021.00	23,920.97	26,185.39	27,469.80
Ratios				
EBITDA Margin	5.89%	7.29%	8.39%	9.21%
PAT Margin	2.09%	3.21%	4.08%	5.06%
Return on Equity	5.22%	8.59%	9.73%	5.93%
ROCE (New)	6.63%	10.21%	12.45%	7.18%
Net Debt/ EBITDA	3.38	2.19	1.17	1.83
Net Debt / Total Equity	0.50	0.43	0.23	0.20

Source: Company Annual Reports, CareEdge Research

Operational KPIs (Rs. Million)-

	FY22	FY23	FY24	H1FY25
Revenue split by segment				
Manufacturing of Machinery & Equipment	15,009.35	20,353.83	20,144.07	NA
Engineering, Procurement and Construction	33,550.88	33,724.72	33,874.86	NA
Sugar	6,079.34	7,653.51	6,083.04	NA
Ethanol	538.41	2,179.63	2,077.95	NA
Plant under construction	-207.13	12.20	10.26	NA
Others	22.57	66.50	3.20	NA
Total Revenue	54,993.43	63,990.39	62,193.37	NA

Source: Company Annual Reports, CareEdge Research

Table 19: CAGR growth of the peer group

Companies	FY22	FY23	FY24	CAGR %
Ardee Engineering Limited	2,168.64	3,312.52	6,209.90	69%
Interarch Building Products Private Limited	8,349.42	11,239.26	12,933.02	24%
JSW Severfield Structures Limited (JSSL)	10,438.31	13,839.25	13,515.11	14%
Pennar Industries Limited	22,657.50	28,946.20	31,305.70	18%
Everest Industries Limited	13,647.06	16,476.34	15,754.52	7%
Macmet Engineering Limited	3,378.98	4,023.80	4,182.64	11%
Capacite Infraprojects Limited	13,398.28	17,985.87	19,316.38	20%
PSP Projects Limited	17,480.63	19,378.06	25,057.89	20%
Ahluwalia Contracts (India) Limited	26,924.69	28,383.93	38,552.98	20%
ISGEC Heavy Engineering Limited	54,993.43	63,990.39	62,193.37	6%

Source: Company Annual Reports, CareEdge Research

KPIs used in peer comparison

KPI	Definition
Revenue from operations	Revenue from operations for the year
Closing Order Book	Total value of Orders pending to be executed as on the relevant date
EBITDA	Earnings before Interest, tax, depreciation and amortization and is computed as Restated profit before exceptional items and tax plus Finance Cost plus Depreciation and amortization
EBITDA Margin	EBITDA during a given period as a percentage of Total Income during that period
PAT	Profit after tax for the year
PAT Margin	Profit for a given year divided by Total Income for that year and is expressed as a percentage
Return on Equity (RoE)	Profit for the period divided by Total Equity
Return on Capital Employed (ROCE)	RoCE is Profit before Interest and Taxes divided by Total Capital Employed. Total Capital Employed is Total Equity plus Borrowings plus Deferred Tax Liability (net)
Total Equity	the aggregate value of the paid-up share capital and other equity of the Company as at period/year end as per Restated financial information. Other equity is calculated as all reserves created out of profits and securities premium account and debit or credit balance of profit and loss account, after deducting the aggregate value of the accumulated losses, miscellaneous expenditure not written off, as per the restated balance sheet, but does not include reserves created out of revaluation of assets, capital reserve, foreign currency translation reserve, write-back of depreciation and amalgamation. Accordingly, it is calculated as other equity excluding the fair value gain (net of tax) recognised on

	measurements of assets at fair value and reserves not created out of the profits
Net Debt	Non-current Borrowings plus Current Borrowings less Cash and cash equivalents, other bank balances and Deposits greater than 12 months
Net Debt to EBITDA ratio	Net Debt divided by EBITDA for the period
Net Debt to Equity ratio	Net Debt divided by Total Equity

Contact

Tanvi Shah	Director – Advisory & Research	tanvi.shah@careedge.in	022 6837 4470
Vikram Thirani	Director – Business Development	vikram.thirani@careedge.in	022 6837 4400

About CARE Analytics & Advisory Private Ltd (CareEdge Research)

CareEdge (CARE Group) is a knowledge-based analytical group that aims to provide superior insights based on technology, data analytics capability and detailed research methods. CareEdge (CARE Ratings Limited) is one of the leading credit rating agencies in India. It has an impressive track record of rating companies for almost three decades and has played a pivotal role in developing the corporate debt market in India. CareEdge provides near real time research on all domestic and global economic developments. CARE Analytics & Advisory Private Ltd is a wholly owned subsidiary focused on providing advisory and consultancy services including the following:

CARE Analytics & Advisory Private Ltd
(Wholly-owned subsidiary of CARE Ratings Ltd.)
B-Wing, 303, Time Square Building, Marol, Andheri-Kurla Road, Andheri East, Mumbai- 400059
Phone: +91-22-68374400

Connect :