

Gears, Shafts and Precision Components Industry Report

Final Report

Jai Parvati Forge Limited

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List of Abbreviations

Abbreviation	Full Form
ACC	Advanced Chemistry Cell
ADAS	Advanced Driver Assistance Systems
AEBS	Autonomous Emergency Braking System
AAT	Advanced Automotive Technology
AIDC	Agriculture Infrastructure and Development Cess
ASEAN	Association of Southeast Asian Nations
ATS	After-Treatment System
BCD	Basic Customs Duty
BE	Budget Estimates
BMS	Battery Management System
BOM	Bill of Materials
BS	Bharat Stage
BTIA	Broad-based Trade and Investment Agreement
BTA	Bilateral Trade Agreement
CAGR	Compound Annual Growth Rate
CAFE	Corporate Average Fuel Efficiency
CAFC	Corporate Average Fuel Consumption
CBIC	Central Board of Indirect Taxes and Customs
CBU	Completely Built Unit
CE	Concrete Equipment
CEV	Construction Equipment Vehicle
CESL	Convergence Energy Services Limited
CFA	Central Financial Assistance

CGST	Central Goods and Services Tax
CHC	Custom Hiring Centre
CKD	Completely Knocked Down
CMM	Coordinate Measuring Machine
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CPI	Consumer Price Index
CV	Commercial Vehicle
CY	Calendar Year
DBT	Direct Benefit Transfer
DDAW	Driver Drowsiness Warning
DISCOM	Distribution Company
DPIIT	Department for Promotion of Industry and Internal Trade
DRHP	Draft Red Herring Prospectus
EV	Electric Vehicle
EFTA	European Free Trade Association
EME	Earth Moving Equipment
ESG	Environmental, Social and Governance
FAE	First Advance Estimates
FAME	Faster Adoption and Manufacturing of Electric Vehicles
FDI	Foreign Direct Investment
FMCG	Fast Moving Consumer Goods
FTA	Free Trade Agreement
FY	Financial Year
GCC	Gross Cost Contract
GDP	Gross Domestic Product
GIS	Geographic Information System

GST	Goods and Services Tax
GPU	Graphics Processing Unit
GVA	Gross Value Added
GVW	Gross Vehicle Weight
HCV	Heavy Commercial Vehicle
HGV	Heavy Goods Vehicle
HP	Horsepower
HPV	Heavy Passenger Vehicle
ICV	Intermediate Commercial Vehicle
ICE	Internal Combustion Engine
ICEMA	Indian Construction Equipment Manufacturers Association
IEA	International Energy Agency
IIP	Index of Industrial Production
IMHCV	Intermediate Medium and Heavy Commercial Vehicle
INR	Indian Rupee
ISM	India Semiconductor Mission
ISTS	Inter-State Transmission System
JNNSM	Jawaharlal Nehru National Solar Mission
L5	Category of a Three-Wheeled Motor Vehicle
LCV	Light Commercial Vehicle
LGV	Light Goods Vehicle
LNG	Liquefied Natural Gas
MCV	Medium Commercial Vehicle
MEP	Minimum Energy Performance
MHE	Material Handling Equipment
MHCV	Medium and Heavy Commercial Vehicle
MHI	Ministry of Heavy Industries

MMBtu	Million British Thermal Units
MoF	Ministry of Finance
MoRTH	Ministry of Road Transport and Highways
MOSPI	Ministry of Statistics and Programme Implementation
MPV	Medium Passenger Vehicle
MSP	Minimum Support Price
MSME	Micro, Small and Medium Enterprise
MW	Megawatt
NBFC	Non-Banking Financial Company
NEBP	National Electric Bus Programme
NIP	National Infrastructure Pipeline
NMP	National Master Plan
NNI	Net National Income
NSO	National Statistical Office
OBD	On-Board Diagnostics
OBM	On-Board Monitoring
OEM	Original Equipment Manufacturer
OHV	Off-Highway Vehicle
OPEC	Organization of the Petroleum Exporting Countries
PFCE	Private Final Consumption Expenditure
PIB	Press Information Bureau
PLI	Production Linked Incentive
PMP	Phased Manufacturing Programme
PNG	Piped Natural Gas
PPP	Public-Private Partnership
PV	Passenger Vehicle
RE	Revised Estimates

RBI	Reserve Bank of India
RCE	Road Construction Equipment
RPO	Renewable Purchase Obligation
SAE	Second Advance Estimates
SCV	Small Commercial Vehicle
SKD	Semi Knocked Down
SMAM	Sub-Mission on Agricultural Mechanization
STU	State Transport Undertaking
SUV	Sport Utility Vehicle
SWS	Social Welfare Surcharge
TCO	Total Cost of Ownership
TPA	Tonnes Per Annum
TREM	Tractor Emission Norms
UAE	United Arab Emirates
UDAY	Ujwal DISCOM Assurance Yojana
UK	United Kingdom
US	United States
VMC	Vertical Machining Centre
WTG	Wind Turbine Generator
ZEV	Zero Emission Vehicle
4WD	Four-Wheel Drive
Tier-I supplier	A supplier that directly supplies components, systems or assemblies to an original equipment manufacturer (OEM)

Module-I: Macroeconomic overview of the Indian economy

Review of Real GDP growth over fiscals 2023-2026 and outlook for fiscals 2026-2031

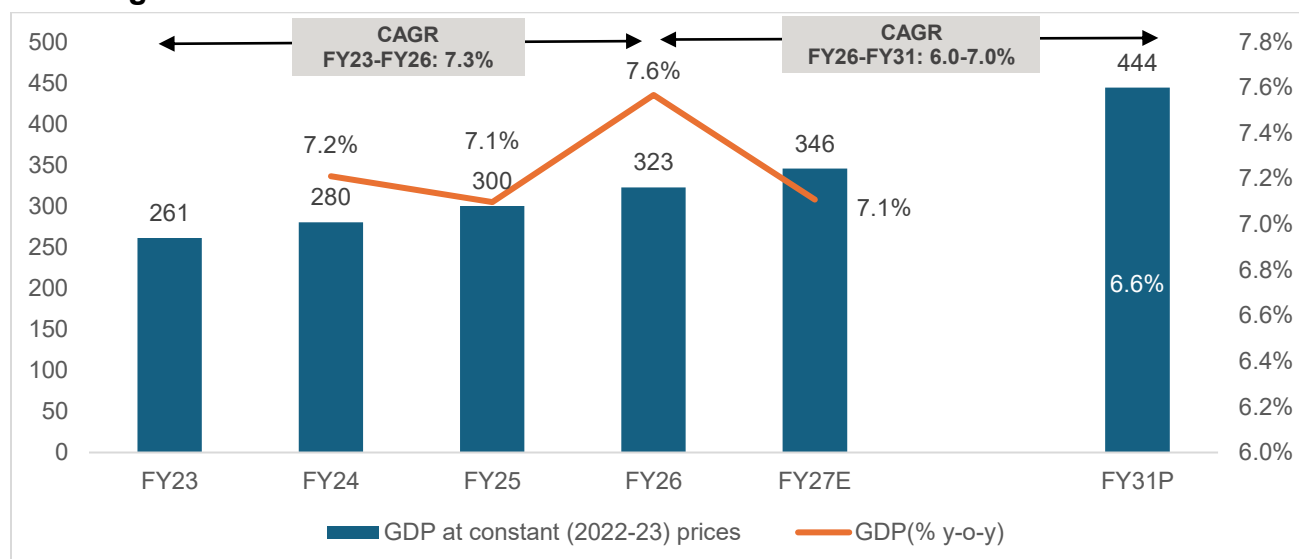
According to the IMF's April 2026 database, India has become the sixth largest economy from the previous fourth place ranking, falling behind UK and Japan. The decline is driven by the depreciation of Indian rupee against the US dollar and a downgrade revision of GDP. Despite this India continues to be among the world's fastest growing major economy with real GDP growth projection between 6-7% outpacing its global peers.

The Indian economy is estimated to have logged a CAGR of 7.3%% between fiscals 2023 and 2026, driven by benign crude oil prices, soft interest rates and low current account deficit. However high growth and low inflation redefine the growth momentum in fiscal 2026. Inflation remains below the lower tolerance level; unemployment is on declining trajectory and export performance continue to improve. Further, the financial environment remains supportive, with readily available credit and low interest rate. Also, the domestic demand remains strong supported by robust private consumption

According to the National Statistics Office's (NSO) Second advance estimates (SAE), India's real gross domestic product (GDP) growth at 7.6% in fiscal 2026 slightly higher than First Advance Estimates (FAE) of 7.4%. The GDP growth accelerated by private consumption where growth revised upward to 7.7% from 7% previously. Further growth is supported by tax relief, rate cuts by RBI, and direct benefit transfers (which have crossed 4 lakh crore).

The real GDP growth is projected to be 7.1% and estimated potential growth rate is also expected to be 7% as per economic survey for 2025-26. Growth will be supported by robust private consumption and a mild pick-up private investment. The positive effects on private consumption from fiscal support includes tax cuts, GST cuts, unconditional cash transfers by states, lower interest rates and benign inflation will spill over into the next fiscal. The private investment sentiment witnessed improvement with a recovery in private capex underway, driven by emerging sectors such as green hydrogen, semiconductor, battery manufacturing and data centres are the key growth areas The central government's capex thrust will continue, with budgetary or effective capex budgeted to grow 22.1% in next fiscal compared with 6% in the revised estimates for this fiscal.

India's GDP growth trend and outlook

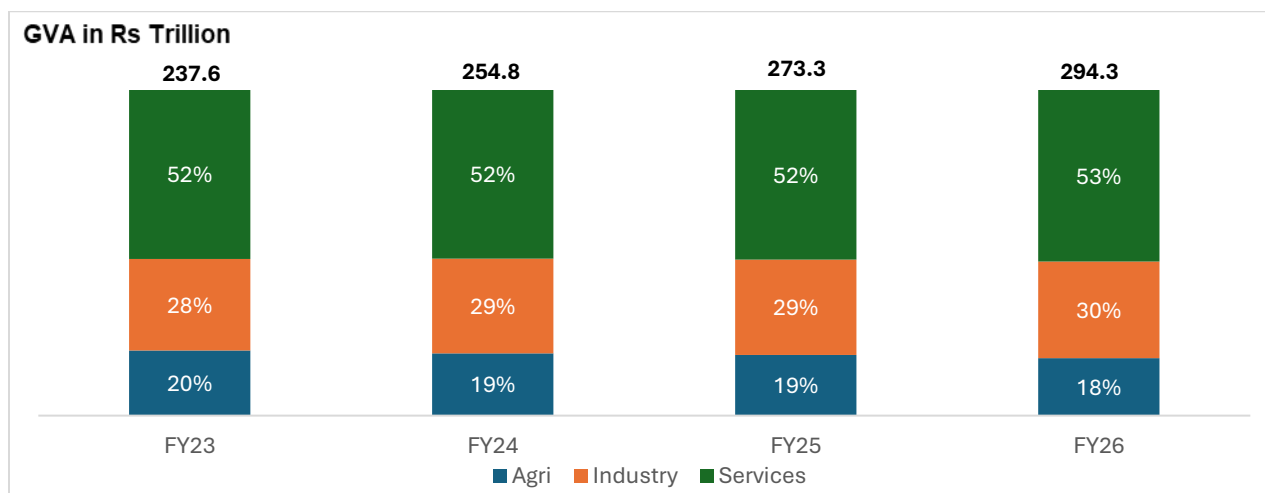


Note: E – Estimated, P – Projected

Source: National Statistical Office (NSO), International Monetary Fund (IMF), Crisil Intelligence estimates

Moreover, CRISIL forecast assumes normal monsoon and crude oil prices at USD 75-80 per barrel. However the ongoing conflict in Middle east poses significant risks to the global economy and could adversely impact India's GDP projections and surge in commodity prices, if the conflicts continue further. Reports of possibility of El Niño condition forming beyond August 2026 according to the National Oceanic and Atmospheric Administration, remain monitorable for the rural economy.

Share of sector in GVA at constant prices



Note: GVA at basic prices (constant 2022-23 prices)

Source: RBI; CRISIL Intelligence

India's Gross Value Added (GVA) at constant prices has demonstrated consistent and robust expansion, growing from Rs 237.6 trillion in fiscal 2023 to Rs 294.3 trillion in fiscal 2026. This absolute growth of Rs 56.7 trillion over a four-year period underscores a resilient macroeconomic environment and steady overall economic progress.

A notable structural trend during this period is the steady expansion of the industrial sector, whose share in total GVA increased from 28% in fiscal 2023 to 30% in fiscal 2026. This moderate but consistent growth in share reflects a strengthening manufacturing base and points toward ongoing industrialization and capacity expansion within the broader economy.

The Indian economy continues to solidify its service-oriented structure, with the services sector maintaining its dominance and increasing its share from 52% in fiscal 2023 to 53% by fiscal 2026. Meanwhile, the agricultural sector's share moderated from 20% in fiscal 2023 to 18% in fiscal 2026. This declining reliance on primary sector activities, alongside the growth in industry and services, is indicative of a broader structural transformation. It aligns with the trajectory of developing economies transitioning toward higher-value sectors.

Industry sector recorded highest growth at 9.3% backed by services at 8% and the Agri sector at 3.1% during the fiscal 2023 to fiscal 2026. Industry growth reached 8.8% in fiscal 2026 compared to 8.3% in fiscal 2025, driven by growth in

manufacturing sector which is expected to grow 11.5% in fiscal 2026 vs 9.3% in fiscal 2025. Electricity (1.5% vs 2.9%) and mining (4.1% vs 11.7%) are expected to soften, partly impacted by an early monsoon. Construction, the most labour-intensive sector, likely saw growth soften but remained healthy at 7.1% in fiscal 2026 compared with 7.3% in fiscal 2025.

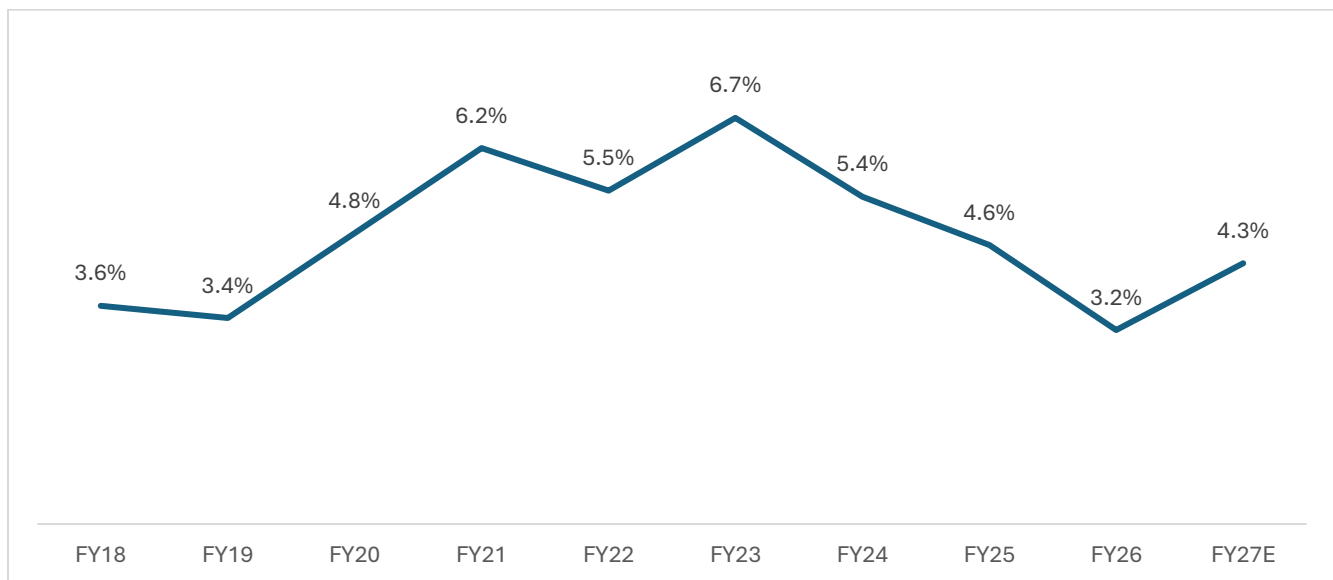
Agriculture and allied GVA growth were revised down to 2.4% in fiscal 2026 from 3.1% during the fiscal 2023 to fiscal 2026. Overall services growth projections were broadly steady at 9% in fiscal 2026 compared with 7.9% in fiscal 2025. But services sub-sectors such as THTC services and public administration services saw large revisions.

Review and Outlook of Consumer Price Inflation (CPI)

Inflation based on the revised Consumer Price Index (CPI) series, with 2024 as the base year, decreased to 3.2% in fiscal 2026 from 4.6% in the previous fiscal as food inflation further normalized even as fuel inflation remained healthy and core inflation was unchanged.

The overarching decline in the CPI was largely driven by the normalization of food inflation. While certain sub-segments like vegetables, spices, fruits and nuts, and oils and fats exerted upward pressure at times, the broader food basket stabilized significantly in FY26, pulling the headline number down. Fuel inflation remained stable and healthy during this period, providing a predictable operating environment for logistics and transportation sectors.

CPI trend



E- Estimated

Source: Ministry of Statistics and Programme Implementation (MOSPI), RBI, CRISIL Intelligence

Outlook on inflation

If the global fuel prices continue to surge, a prolonged crisis will have significant upward pressure on transportation sector, particularly petrol, diesel, Compressed Natural Gas (CNG) and airfare.

CRISIL expects CPI inflation to rise to 4.3% on average in fiscal 2027. While food prices are expected to remain healthy, the expected heatwaves this summer, as well as the possibility of El Niño conditions coinciding with India's southwest monsoon season, also pose a risk to food prices and reviewing.

Review of Per capita income

According to the revised estimates by the National Statics Office (NSO) New Series of Annual and Quarterly National Accounts Estimates with base year 2022–23, the per capita income (per capita net national income; NNI) is estimated to have grown 7.6% in fiscal 2026, compared with 7.4% in fiscal 2025 and 7.6% in fiscal 2024 as per the latest release of new series of national income with base year 2022-23.

In fiscal 2021, the per capita income declined 8.9% owing to GDP contraction, driven by the pandemic impact. The per capita income rose 7.6% in fiscal 2022 on the lower base of fiscal 2021.

According to the IMF's estimates, India's per capita income (at current prices) is expected to log a CAGR of 9.5% over calendar years 2026-2031.

Indian economy is expected to surpass the USD 5 trillion mark over the next few fiscals (2026- 2030) and inch closer to USD 7 trillion. A projected average GDP growth of 6-7% in this period (fiscal 2026- fiscal 2031) will lift its per capita income to the upper middle-income category. By fiscal 2031, India's per capita income is expected to rise to ~USD 4,420, thereby making it an upper middle-income nation.

The anticipated growth in per capita income is poised to enhance disposable income and purchasing power, thereby driving up demand for personal vehicles, including two-wheelers and passenger vehicles. Further, the rising incomes are likely to fuel a trend of premiumisation in these segments, where consumers opt to upgrade to higher-end vehicles and variants, seeking enhanced feature and quality

Review of Index of Industrial Production (IIP)

The Index of Industrial Production (IIP) marginally increased to 4.1% in March 2026 compared to 3.9% in March 2025 amid the critical input shortage of crude, petroleum products and natural gas in the first month of the West Asia conflict. Manufacturing and electricity slowed, while mining expanded. The IIP slowdown indicates the first wave of the energy shock and global trade disruptions. It ties in with the manufacturing PMI (Purchasing Managers' Index) moderating in March 2026, albeit remaining in expansion zone.

Worst hit were sectors most dependent on energy or other critical inputs from West. These included chemical products and construction inputs, which feeds into other sectors. Some export-oriented sectors such as textiles and electronics faced the twin impact of input cost pressures and global trade disruptions. However, sustained strength in heavyweights such as automobiles and machinery supported headline IIP growth, driven by strong domestic demand.

The coming quarters, expected to foresee the downside and upside risks to growth due to combination of factors such as higher prices and tighter supply of critical inputs due to the ongoing conflict in West Asia has imposed downside risks to industrial output. With gas (natural and liquefied gas) availability under pressure, the government has tried to ration supplies to industries. However, those with heavy dependence on gas and derivatives as key inputs could see disruptions in their output.

Other key challenges faced by manufacturers are surge in energy prices over the past three fiscals, a favourable input cost environment and improving domestic demand allowed firms to expand their margins steadily by 18-19%. That trend

is now reversing. Rising input costs are emerging as a key pressure point, and uneven pricing power across firms may limit their ability to fully pass through costs.

Healthy domestic demand scenario, though, provides support currently. The uncertainty due to the continuing turmoil in West Asia is not only casting a shadow over India's macroeconomic outlook but if extended, can also delay business decisions and deter the recovery in private investments

Review of geopolitical risks and their impact on Automotive

The Auto manufacturers and suppliers particularly sectors such as casting and forging rely on piped natural gas (PNG) and Liquefied Natural Gas for heat intensive processes. A rise in LNG prices or supply constraints, raises input costs for auto component manufacturers and can lead to increased vehicle prices.

In March 2026 severe LNG supply restriction to regions of Europe and Asia following attacks on critical energy infrastructure in the Middle east and disruption in the strait of Hormuz. The Iranian missile strikes on Qatar's LNG infrastructure, the largest LNG facility in the world caused extensive damage to several LNG trains.

The International Energy Agency (IEA) has marked this disruption as a severe threat to global energy security ,with the potential for prolonged shortages that will restructure global energy trade routes.

Iran -US -Israel conflict

US and Israeli strikes on Iran triggered severe restriction on shipping through the strait of Hormuz, the world's most critical oil chokepoint. Daily vessel transits reduced up to 95%.Container rates from North Asia to UK rose 37% m-o-m in March 2026 while North Asia to US west coast increased 13%.Intra -Asia routes saw freight cost double (from USD 30-40/mt to USD 60-80/mt).Iran has threatened to block the strait of Hormuz in response to US sanctions and military actions. If shipping is continued to be impacted through this route, it could have significant impacts on global oil supplies.

Impact on key raw material and components

The Gulf cooperation Council accounts for 8.3% of global aluminium production. Logistical constraint through Hormuz have impeded exports, while physical damage to regional smelters (eg-Qatar, Bahrain) further reduced availability.

European Aluminium flagged double digit spikes in metal and electricity prices which directly impact the Aluminum casing, heat exchangers and EV structures. With overseas supply tight, China is ramping up exports of semi-finished and finished aluminium products (up 11.9% and 28.4% y-o-y in Jan-Feb 2026 respectively)

Escalating tensions tied to the Iran war are introducing both indirect and direct disruption risk to high-tech supply chains.

The Middle East supports critical supply chains associated with semiconductor manufacturing and electronics production, creating potential risks for automotive electronics and component availability

Petrochemical supply chains support the production of critical electronic materials used in automotive semiconductors, printed circuit boards, sensors and electronic control units. Volatility in these raw materials may increase the cost of automotive electronics and disrupt component availability

Shipping and logistics disruptions

Rising uncertainties in the middle east have pushed global crude oil prices USD 80-85 per barrel compared to USD 62.7 per barrel in December 2025. Although Iran accounts for around 4.5-5% of the global crude oil supply, the key risk remains blockade of the Strait of Hormuz, as 20% of crude oil trade passes through the strait of Hormuz. The strait of

Hormuz is strategically significant, and disruption can materially impact global energy trade by delaying supplies, raising shipping costs and lifting the price of energy globally.

Nearly a fifth of the seaborne global petroleum product transits through this narrow channel that links the Persian Gulf to the Gulf of Oman and the Arabian Sea.

Spike in spot LNG prices

Physical disruption of shipping routes through the Strait of Hormuz through which ~20% of global and 53-58% of India's LNG transits has created a critical supply bottleneck and heightened procurement risks. Production outages at Qatar's LNG facilities have directly reduced global supply availability, creating immediate tightness in the spot market. Direct attacks on Qatar's LNG facilities in March 2026, have severely disrupted global energy supply chain and triggered a long term supply shortage across Europe and Asia region .

Qatar accounts for ~45% of India's LNG import basket, representing the most concentrated exposure in India's import portfolio. Elevated geopolitical tensions have driven up war-risk insurance premiums for vessels transiting risk-laden zones, significantly increasing the delivered cost of LNG to India.

The combination of Qatari production disruptions and shipping constraints has reduced the volume of LNG available in the spot market globally. Spot LNG prices have surged from \$10 per MMBtu to nearly \$25 per MMBtu within days of situation escalating, reflecting both immediate supply shock and broader market uncertainty.

Crude oil prices surge on critical transit disruptions

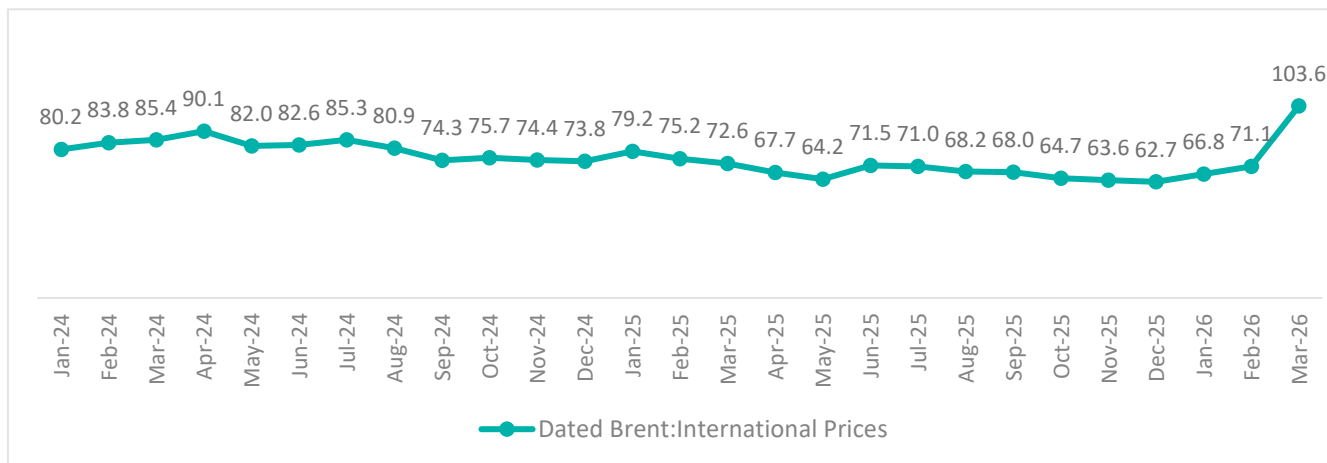
In March 2026, crude oil prices jumped 45% to an average of USD103.6/barrel, as Middle East tensions sparked fears of supply disruption. The risk of interruptions to oil flows, especially through the critical Strait of Hormuz, prompted investors to add a premium to crude prices, fueling a significant price surge.

Crude oil prices in Q1 FY2027 are estimated at USD95-100/barrel significantly compared to USD 67.8/barrel in Q1 FY2026. A sharp rise in crude oil prices led by near term supply tightness and transit constraints amid partial rerouting. However, as supply and transit conditions gradually normalize, prices are expected to be average USD 82-87/barrel for the full fiscal year 2027.

In CY2025 crude oil prices averaged USD 69.1 /bbl with moderation in demand growth due to imposition of tariff creating trade uncertainty coupled with steady supplies especially from non-OPEC nations. Output from OPEC nation increased notably in phased manner in second quarter of CY2025 keeping supplies high and dragging prices further. OPEC+ completely reserved cuts ~2-2 mbpd by September 2025 and announced moderate hikes in December 2025. While the prices surged temporarily when US imposed sanctions on Russia in 1st quarter of the CY2025 and due to geopolitical uncertainty in Middle east in June 2025, it came back to equilibrium level of ~USD65-70/bbl range.

The upside and downside risk to the prices rely on OPEC's decision of cut reversal and global demand growth in turn impacted by interest rates, tariff wars etc. The global crude oil demand is expected to increase by 0.5-1.5 mbpd in CY2026 with projected growth of 2.7%, slightly higher than 2025 level. The global demand will largely be driven by aviation fuels, LPG and petrochemicals in medium term while shift to alternate fuels and EV penetration to weigh on the traditional transport fuel demand. The latest increase in trade tensions signals a prolonged period of uncertainty, particularly due to the unstable global regulatory landscape. This affects multiple areas simultaneously, including domestic and international policies, such as electric vehicle subsidies and tariffs, which are creating an uncertain environment

Brent Crude prices (USD/barrel)



Sources:

CRISIL Intelligence

In fiscal 2026, Crude oil prices declined to \$70/bbl from \$79/bbl in fiscal 2025 with moderation in demand growth due to imposition of tariffs creating trade uncertainties coupled with steady supplies especially by Non-OPEC nations. Output from OPEC nations increased notably in phased manner in 2nd quarter of 2025 keeping the supplies high and dragging prices further. OPEC+ completely reversed the voluntary cuts of ~2.8-3.0 mbpd by Dec 2025, and announced pause to further hikes in 1st quarter of 2026. While prices surged temporarily when US imposed sanctions on Russia in 1st quarter of the year and due to geopolitical uncertainties in Middle East in June, it came back to equilibrium levels of ~65-70/bbl range. The global crude oil demand is majorly driven by aviation fuel while shift to alternative fuel and EV Penetration to weigh on the traditional transport fuel demand.

The outlook reflects current supply and transit disruption, any incremental impact on oil could sustain upward pressure on the prices. On the other hand, an improvement in transit conditions, particularly through the Strait of Hormuz, could help moderate prices. In the short term, prices are likely to remain volatile due to geopolitical risks and uncertainty surrounding the duration of the current disruptions.

CRISIL Intelligence expects crude oil prices remain within the range of \$103-108 per barrel in April 2026, as uncertainties around middle east continue leading to production disruptions in key oil producing nations and supply side constraints especially through Strait of Hormuz impacting more than 20% of the world crude oil sea borne trade. In our view, it will take several weeks for global oil supply and trade scenario to normalize after the conflict ends.

Impact of Government Policies

PLI scheme provides boost to industrial investments in the short-to-medium term

The PLI scheme aims to make India's manufacturing globally competitive by removing sectoral obstacles and creating economies of scale. The scheme, implemented from 2022 to 2029, has already shown significant results:

The PLI scheme aims to make India's manufacturing globally competitive by removing sectoral obstacles and creating economies of scale. The scheme, implemented from 2022 to 2029, has already shown significant results:

- ~Rs 2 lakh crore in realised investments across 14 sectors as of September-2025
- Rs 18.7 lakh crore in revenue generated

- ~12.6 lakh jobs created directly and indirectly

The scheme provides time-bound incentives to companies, rewarding them 5-15% of their annual revenue for achieving pre-decided targets for production, exports and capital expenditure. The scheme has led to a revival in capital expenditure and is expected to boost economic growth and create more employment opportunities.

The automobile and auto component sector saw a sharp increase in the allocation in the past few years—from Rs 2.63 crore in fiscal 2024 to Rs 346.87 crore in fiscal 2025 to Rs 2,818.85 crore for fiscal 2026.

The Union budget 2026-27 has increased the PLI scheme allocation for automobile and auto component to Rs 5,939.87 crore, a major rise from the revised 2025-26 estimates of Rs 2,091.26 crore. This surge supports 82 approved applicants in accelerating manufacturing and advanced automotive technology (AAT) and EVs.

Budgeted incentives for each sector under the PLI scheme

SECTOR	SEGMENT	FY26 Revised Estimates (RE) (Rs crore)	FY27 Budget Estimates (BE) (Rs crore)
Electronics	Electronic manufacturing and hardware	6,960	1,345
Pharma	Pharmaceuticals	2,300	2,250
Automobile	Advance chemistry cell (ACC) battery	13	86
	Automobiles and auto components	2,091	5,940
Textile	Textile	400	405
White goods	Air conditioners and LED lights	304	1004
Steel	Specialty steel	193	380

Source: PIB, budget documents, Crisil Intelligence

PLI Auto scheme promotes manufacturing of advanced automotive technology vehicles and components. It attracted Rs 35,657 crore in investment and created 48,974 jobs till September 2025.

Atmanirbhar Bharat campaign

The Atmanirbhar Bharat Abhiyan or the self-reliant India campaign was launched in May 2020 amid the Covid-19 pandemic, with a special and comprehensive economic package of Rs 20 trillion, equivalent to 10% of the country's GDP.

The stimulus package announced by the government under the scheme consisted of five tranches, intended to boost businesses, including Micro, Small and Medium Enterprises (MSMEs), help the poor (including farmers), boost agriculture, expand the horizons of industrial growth, and bring in governance reforms in the business, health, and education sectors.

The mission emphasizes the importance of encouraging local products and aims to reduce import dependence through substitution and enhance compliance and quality requirements to meet international standards and gain global market share. The mission will support in bolstering manufacturing activity in the upcoming EV sector by prioritising domestic production to reduce import dependency, adopt technological innovation and create job opportunities in the country.

The government has also rolled out other reforms, such as supply chain reforms for agriculture, rational tax systems, simple and clear laws, capable human resources and a strong financial system. These reforms will further promote business, attract investment and strengthen the Make in India initiative.

Make in India

The 'Make in India' initiative was launched in September 2014 to give a push to manufacturing in India and encourage FDI in manufacturing and services. The objective of the initiative was to increase the share of manufacturing in GDP to 25% by 2020 by boosting investment, fostering innovation and intellectual property. It also aimed to build best-in-class infrastructure for manufacturing across sectors, including but not limited to automobile, auto components, aviation, biotechnology, chemicals, defence manufacturing, electrical machinery, electronic systems, food processing, mining, oil and gas, pharmaceuticals, renewable energy, thermal power, hospitality and wellness.

In the Union Budget 2025-2026, the government announced the National Manufacturing Mission, covering small, medium and large industries to bolster the 'Make in India' initiative, providing policy support, execution road maps and a governance and monitoring framework for central ministries and states. The mission will also support clean tech-related manufacturing. The aim is to improve domestic value addition and build an ecosystem for solar photovoltaic (PV) cells, electric vehicle (EV) batteries, motors and controllers, electrolyzers, wind turbines, very high voltage transmission equipment and grid scale batteries.

The 'Make in India' initiative has been a catalyst for the auto industry, drawing substantial investments from domestic and foreign sources. This influx of investment has been facilitated by a range of supportive policies and incentives, including the PLI scheme and a reduced GST rate on electric vehicles (EVs). Notably, the GST Council, in a meeting held in September 2025, reaffirmed the continuation of the lower GST rate for EVs. This decision offers a significant tax advantage for EVs over their conventional petrol and diesel counterparts, which are subject to a much higher GST rate. Although the GST 2.0 framework did not introduce further reductions in GST rates for EVs, the existing lower rate continues to provide a considerable incentive, promoting the adoption of electric vehicles in India.

Supply chain diversification trend in global manufacturing and procurement policies

The supply chain diversification strategy has reshaped global manufacturing and sourcing patterns, driven by the need to reduce over-dependence on a single country. While China continues to be a critical node in global manufacturing, recent geopolitical tensions, pandemic-induced disruptions and rising labour costs have compelled companies to explore alternative destinations to ensure operational continuity and cost efficiency. The objective of the strategy is not to replace China entirely but to complement existing operations by expanding into countries such as India, Vietnam, Indonesia and Mexico. This shift is helping companies to access new markets, leverage favourable trade agreements and reduce exposure to policy-related uncertainties.

For India, the supply chain diversification strategy presents a medium-to-long-term opportunity to integrate more deeply into global value chains. With its large and skilled labour force, improving infrastructure and government-backed initiatives, such as the PLI scheme and make in India, the country is well-positioned to absorb incremental investments from multinational corporations looking to diversify. In sectors such as electronics, pharmaceuticals, textiles and automotive components, several companies have already begun to relocate or expand production into India.

This has translated into rising foreign direct investment (FDI) inflows, new manufacturing partnerships and greater emphasis on domestic sourcing, thereby boosting the country's industrial ecosystem. Further, this trend aligns with India's broader economic strategy of import substitution, employment generation and becoming a global manufacturing hub. Over the next few years, the supply chain diversification strategy is expected to strengthen India's role as a strategic alternative

in global manufacturing. Continued policy support, regulatory simplification and timely execution of infrastructure projects will be key to sustaining investor confidence and capitalising on this evolving global realignment.

Increased focus on foreign trade agreement

India is actively negotiating and reviewing bilateral trade agreements with major global economies to boost its trade prospects.

India signed a trade and economic partnership agreement with the European Free Trade Association (EFTA) on March 10, 2024, and the India-UAE bilateral investment treaty came into effect on August 31, 2024.

It is also in the process of reviewing its 2009 trade agreement with the Association of Southeast Asian Nations (ASEAN) to make it more equitable and aligned with current economic realities.

India and the UK signed a landmark FTA in July 2025 to improve bilateral trade and investment flows. The agreement is expected to double trade between the two nations—currently valued ~USD 60 billion—by 2030. Under the deal, India will gain near-complete duty-free access for its exports to the UK, especially in key sectors, such as textiles, gems and jewellery, engineering goods and processed foods. In return, the UK will benefit from phased tariff reductions on high-value goods such as automobiles, Scotch whisky, medical devices and premium food products. The FTA also introduces streamlined customs procedures and a special mobility pathway for Indian professionals.

Beyond goods trade, the agreement includes provisions on digital trade, services, intellectual property and government procurement. A key highlight is the social security pact that exempts Indian professionals from double contributions for up to three years, benefiting around 75,000 workers. The deal is also aligned with sustainability and ESG goals, featuring cooperation on clean energy and green technology. The India-UK FTA is a strategic milestone that strengthens India's trade diversification strategy, complements the supply chain diversification trend and reinforces its position in global supply chains.

India -EU (European Union) Free Trade Agreement (FTA)

The India-EU FTA, also known as the Broad-based Trade and Investment Agreement (BTIA), aims to liberalise trade in goods, services and investment between India and the 27-member European Union. The negotiations were launched in CY2007, but progress was slow due to various challenges and disagreements.

On 17th June 2022, the European union relaunched negotiation with India for FTA. The negotiations for India-EU FTA have made significant progress and concluded on 27th January 2026. The FTA covers 25% of global GDP and targets to double bilateral trade to USD 250 billion within a decade. The trade deal will potentially support manufacturing and service sector between India and EU. Reduction over 90% of tariff expected to double EU goods exports to India.

The India-EU FTA is expected to have a notable impact on trade and investment between the two regions. According to Industry estimates, the agreement could increase bilateral trade by up to 20% and attract significant investment into India. Overall, the India-EU FTA has the potential to be a game-changer for trade and investment between the two regions.

Unites States (US)-India Bilateral Trade Agreement

US and India announced framework for an interim trade agreement in February 2026, affirming countries' commitment to the broader U.S.-India Bilateral Trade Agreement (BTA) negotiations launched in February 2025, which will include additional market access commitments and support more resilient supply chains.

The Interim agreement between the US and India showcase a common commitment to reciprocal and balanced trade based on mutual interest and concrete outcomes.

Under this interim agreement, India will eliminate or reduce tariffs on all U.S. industrial goods and a wide range of U.S. food and agricultural products.

India intends to purchase \$500 billion of U.S. energy products, aircraft and aircraft parts, precious metals, technology products, and coking coal over the next 5 years. India and the United States will significantly increase trade in technology products, including Graphics Processing Units (GPUs) and other goods used in data centres, and expand joint technology cooperation.

The US will apply a reciprocal tariff rate of 18 percent on originating goods of India, including textile and apparel, leather and footwear, plastic and rubber, organic chemicals, home décor, artisanal products, and certain machinery, and, subject to the successful conclusion of the Interim Agreement, will remove the reciprocal tariff on a wide range of goods including generic pharmaceuticals, gems and diamonds, and aircraft parts. India will also receive a preferential tariff rate quota for automotive parts.

The United States and India agree to strengthen economic security alignment to enhance supply chain resilience and innovation through complementary actions to address non-market policies of third parties, as well as cooperation on inbound and outbound investment reviews and export controls.

Foreign Direct Investment (FDI)

FDI plays a pivotal role in economic growth, aiding development and shaping the economic landscape. Through the FDI route, international corporations can invest in India, capitalising on the investment incentives offered by the Indian government, including tax incentives and relatively competitive labour costs. This fosters job creation, offers various additional advantages and facilitates the acquisition of technological expertise from global peers.

There are two FDI routes in India—the government route and the automatic route. The automatic route allows foreign investors to invest in sectors without requiring a prior approval from the Indian government. Under this route, investors are only required to notify the Reserve Bank of India (RBI) within a specified time frame. While the government route mandates prior approval from the Indian government or relevant authorities for investments in India.

The automobile (including auto components) industry is one of the largest, fastest-growing sectors in India, with a significant contribution to the country's GDP. The sector has attracted significant FDI over the years, driven by government policies, a large domestic market and skilled workforce.

Summary of FDI in key Indian sectors

SECTOR	FDI CAP	ROUTE
Automobile and auto components	100%	Automatic
Airports - greenfield projects	100%	Automatic
Satellites - manufacturing and operation, satellite data products and ground segment and user segment	74%	Government
Hospitals sector	100%	Automatic

SECTOR	FDI CAP	ROUTE
Defense	74%	Automatic Government route up to 100% if resulting in access to modern technology

Source: Department for Promotion of Industry and Internal Trade DPIIT, PIB

FDI to India almost doubled to USD 83.6 billion in fiscal 2022 from USD 45.15 billion in fiscal 2015. Over the past decade (April 2014 to September 2024), total FDI inflows amounted to USD 709.84 billion, accounting for 68.69% of the overall FDI inflow in the past 24 years. This robust inflow of investments underscores India's pivotal role in shaping the global economic landscape. FDI inflows have received an impetus, with India gaining the eighth position in the list of the worlds' largest FDI recipients in 2022 from 12th in 2018, according to the World Investment Report 2024. From 2000 to 2024, a total FDI inflow of USD 991 billion was recorded. FDI equity inflow in the manufacturing sector rose from USD 98 billion in 2004-2014 to USD 165 billion in 2014-2024, demonstrating a 69% increase. The FDI inflow grew to USD 81.04 billion in fiscal 2025 from USD 71.28 billion in fiscal 2024 marking 14% growth. Based on quarterly numbers, FDI inflows rose to USD 25.9 billion in the second quarter of fiscal 2026, compared to USD 21.1 billion in the same quarter of fiscal 2025.

PM E-Bus

As the world's fastest-growing major economy, India is rapidly transforming its transportation sector with a focus on electric vehicles (EVs), particularly electric buses (e-buses). The government's initiatives, such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, the Production-Linked Incentive (PLI) scheme for Advanced Chemistry Cell (ACC) batteries, and the National Electric Bus Programme (NEBP), have been instrumental in driving this growth. As of early 2025, over 12,000 e-buses have been deployed or tendered through Convergence Energy Services Limited (CESL) under various state transport undertakings (STUs).

Import Duty Structure for E-Buses and Components

The Indian government has implemented a tiered import duty structure to promote domestic manufacturing and reduce *dependence on imports. The current duties, as per the Union Budget 2025-26 and the Central Board of Indirect Taxes and Customs (CBIC) notifications, are as follows:

Sr. No.	Description	Effective Rate of Custom Duty
1	CBU of Buses	20% + 20% AIDC
2	SKD (Semi-Knocked Down) of Buses	20% BCD + 5 AIDC
3	CKD (Completely Knocked Down) of Buses	15% BCD
4	Second-hand Buses	20% BCD + 20% AIDC
5	Lithium-ion battery cells	20% BCD + 10% SWS

Source: SIAM, Customs

BCD: Basic Customs Duty; AIDC: Agriculture Infrastructure and Development Cess; SWS: Social Welfare Surcharge

These duties are expected to rise once the ACC battery manufacturing plants under the PLI scheme become fully operational. The government has also imposed phased manufacturing programs (PMP) for EVs and components to gradually increase local value addition.

Subsidies and Incentive Framework

The Indian government offers various subsidies and incentives to promote the adoption of e-buses. The FAME-II scheme provides subsidies up to ₹50 lakh per e-bus, depending on the bus length and battery size. The scheme targets 7,090 new e-buses under the NEBP led by CESL, with cities like Delhi, Mumbai, Bengaluru, and Surat being major beneficiaries.

The PLI scheme for ACC battery manufacturing, with an outlay of ₹18,100 crore, incentivizes domestic battery cell production, crucial for reducing import dependence. Key winners include Reliance New Energy, Ola Cell Technologies, and Rajesh Exports, with over 30 GWh of cumulative capacity expected by 2026.

State-level incentives, such as those offered by Maharashtra, Gujarat, and Tamil Nadu, provide additional support for EV manufacturing plants. Delhi's EV policy (2023-2026) provides operational subsidies for buses under DTC and DIMTS contracts.

Localization Mandates and Technology Transfer

The Ministry of Heavy Industries (MHI) has mandated a minimum 50% domestic value addition for e-buses availing FAME subsidies. Manufacturers are expected to localize key components such as chassis, traction motors, control units, and battery packs. Industry players, such as Olectra Greentech, JBM Auto, and PMI Electro Mobility, are collaborating with global partners for technology sharing while expanding local manufacturing footprints.

However, challenges persist, including limited domestic battery cell manufacturing, forcing imports from China and Korea. The lack of standardized battery management systems (BMS) affects interoperability, high financing costs and uncertain resale value deter private sector adoption.

Key Challenges in India's E-Bus Sector

- **Infrastructure Deficit:** Limited depot charging facilities and grid integration hinder the widespread adoption of e-buses.
- **Cost Barriers:** Despite subsidies, e-bus costs are 1.5 to 2 times higher than diesel, making them less competitive.
- **Supply Chain Dependence:** India's reliance on imported critical EV components, such as cells and semiconductors, poses a significant challenge.
- **Technology Gaps:** The need for indigenous battery chemistry suited for India's climate and the lack of standardized BMS affect the sector's growth.
- **Operational Model Constraints:** Delays in STU payments and tender complexities slow deployment and hinder the sector's progress.

Jawaharlal Nehru National Solar Mission

The Jawaharlal Nehru National Solar Mission (JNNSM) is one of India's flagship renewable energy programs launched in 2010 by the Government of India under the National Action Plan on Climate Change. Implemented by the Ministry of New and Renewable Energy, the mission was designed to transform India into a global solar power leader by rapidly expanding solar generation capacity, reducing solar power costs, promoting domestic manufacturing, and improving energy access.

Initially targeting 20 GW of solar capacity by 2022, the ambition was later scaled up significantly as solar tariffs fell and demand increased. The mission supports utility-scale solar parks, rooftop solar systems, off-grid solutions, and solar manufacturing, creating a comprehensive ecosystem across generation, transmission, and supply chains.

JNNSM has significantly reduced solar tariffs in India, boosted installed capacity, attracted global investment. And strengthened India's position in the renewable energy transition while improving long-term energy security and sustainability.

Solar Rooftop Subsidy Scheme

The Solar Rooftop Subsidy Scheme is a central government initiative to promote installation of rooftop solar systems for residential consumers across India. It is implemented by the Ministry of New and Renewable Energy under the Government of India, and recently strengthened through the PM Surya Ghar: Muft Bhijli Yojana.

- The scheme provides financial subsidies to households installing grid-connected rooftop solar systems. The objective is to:
- Reduce electricity bills for middle- and low-income households
- Increase adoption of renewable energy
- Reduce pressure on distribution companies
- Support India's clean energy and climate commitments

Eligible households can install rooftop solar panels and receive a direct subsidy transfer to their bank accounts after installation and inspection.

Key features

- Central Financial Assistance (CFA) available for systems up to a specified capacity
- Higher subsidy support for smaller systems to encourage mass adoption
- Consumers can export surplus electricity to the grid
- Electricity bills are adjusted based on net consumption
- Installation through registered vendors
- Technical approval and inspection by local Discom
- Subsidy credited directly to beneficiary's account
- Access to collateral-free loans via banks
- Standardized technical specifications for quality control

The Solar Rooftop Subsidy Scheme has accelerated residential solar adoption in India by lowering the upfront cost barrier for households. By providing direct financial assistance, the scheme reduces payback periods and makes rooftop solar financially attractive for middle- and lower-income consumers. It has helped decrease household electricity bills, reduced peak demand pressure on DISCOMs, and promoted decentralized power generation. The initiative has also stimulated growth in the rooftop solar installation ecosystem, creating employment opportunities for vendors, technicians, and manufacturers. Environmentally, it contributes to lower carbon emissions and reduced reliance on fossil fuels, supporting India's broader clean energy and climate objectives while strengthening long-term energy security.

Solar Energy Subsidy Scheme

The Solar Energy Subsidy Scheme refers to government-backed financial support programs designed to promote the adoption of solar power across residential, commercial, and institutional segments. These schemes are primarily

implemented by the Ministry of New and Renewable Energy under the Government of India, with support from the state governments and DISCOMs.

The scheme provides Central Financial Assistance (CFA) to reduce the upfront cost of installing solar systems, particularly rooftop solar for households. The objective is to:

- Promote clean and renewable energy
- Reduce electricity costs for consumers
- Lower dependence on fossil fuels
- Support India's climate and energy security goals

Under recent reforms such as PM Surya Ghar: Muft Bhijli Yojana, eligible residential consumers can receive direct subsidies credited to their bank accounts after installation and approval.

Key features

- Subsidy for residential rooftop systems (typically up to a certain kW capacity)
- Direct Benefit Transfer (DBT) of subsidy amount
- Net metering facility allowing export of surplus electricity to the grid
- Standardized technical guidelines and empaneled vendors for quality and assurance
- Financing support through public sector banks

The scheme has reduced the payback period of rooftop solar systems, making them more financially viable for households. It has encouraged decentralized energy generation. Reduced stress on conventional power infrastructure, created employment in installation and maintenance services, and contributed to carbon emission reduction. Over time, it strengthens energy independence at both household and national levels while supporting India's renewable energy transition.

UDAY Scheme (Ujwal DISCOM Assurance Yojana)

UDAY scheme was launched in 2015 by the Government of India to address the severe financial stress faced by the state-owned electricity distribution companies (DISCOMs). The scheme aimed to improve the operational and financial efficiency of DISCOMs by restructuring their debt and enforcing reforms in billing, metering, and tariff rationalization.

UDAY was designed as a financial turnaround and reform package where:

- State governments took over 75% of DISCOM debt and issued bonds to reduce interest burdens.
- DISCOMs committed to operational improvements and loss reduction targets.
- Tariff revisions were encouraged to reflect actual costs of power supply.

Initially, UDAY reduced interest costs and temporarily improved DISCOM financial health. However, structural challenges such as delayed tariff hikes, rising power purchase costs, and operational inefficiencies limited long-term success. Despite mixed outcomes, UDAY highlighted the importance of financial discipline and structural reforms in strengthening India's power distribution sector and enabling renewable energy integration.

Infrastructure

Infrastructure is not just a sector in India; it is a macro-economic growth strategy. Public capital expenditure on roads, railways, ports, power, and digital infrastructure acts as both a short-term demand stimulus and a long-term supply-side reform.

Contribution to GDP Growth: Government spending on highways, rail corridors, and urban transport immediately boosts aggregate demand through construction activity, steel, cement, and labour employment. This supports GDP growth, especially during private investment slowdowns. Programs such as the National Infrastructure Pipeline (Rs.100+ lakhs crore planned investment) and PM Gati Shakti aim to coordinate investments across sectors to reduce inefficiencies and duplication.

Employment Generation: Infrastructure project creates direct employment (construction, engineering project management) and indirect employment (raw materials, transportation, services). The construction sector alone contributes significantly to non-agriculture employment, especially for semi-skilled labour.

Logistics and Competitiveness: Initiatives like Bharatmala Pariyojana and Sagarmala Programme aim to reduce logistics costs, improve export competitiveness, and boost manufacturing under Make in India.

Crowding-In Private Investment: Improved roads, ports, power supply, and digital connectivity reduce business risk and attract private domestic and foreign investment. Infrastructure stability supports sector like:

- Manufacturing
- E-commerce
- Renewable energy
- Real estate and urban development

Infrastructure acts as both a demand stimulus (short-term growth driver) and a supply-side reform (long-term productivity enhancer). It strengthens India's growth trajectory, improves global competitiveness, supports industrialization, and enhances regional economic integration.

Government's focus on infrastructure

The national infrastructure pipeline (NIP) for fiscal 2019-2025 is a government initiative to develop infrastructure across the country and provide world-class services to its citizens. The total capital expenditure in infrastructure sectors in India during fiscals 2020 to 2025 was projected at Rs 111 lakh crore.

The Union Finance Ministry announced on 27th January 2026 second pipeline of 852 infrastructure projects focusing highways to be done in Public -Private partnership (PPP) with the target cost ~ Rs 17 trillion. The government is transitioning towards NIP 2.0 with a three-year project pipeline fiscal 2025 to fiscal 2027 focused on projects majorly in roads and power sectors.

The highest number of projects expected to come under the Union Ministry of Road Transport and Highway (MoRTH)- 108 projects, with an estimated cost Rs ~8.76 trillion as per data provided by ministry. In addition to that, MoRTH will also take up investment in access-controlled highways to build a high-speed quadrilateral of expressway.

Gati Shakti

The PM Gati Shakti National Master Plan (NMP) is a government-led transformative initiative aimed at overhauling India's infrastructure development framework. By removing bottlenecks and enabling multimodal connectivity across road, rail,

ports, airports, and logistics infrastructure, the initiative is designed to reduce project delays, cut logistics costs and improve the ease of doing business.

The initiative aims to support the manufacturing ecosystem by improving last-mile connectivity to industrial parks, economic zones, freight corridors and export hubs.

According to the roadmap outlined by the government, infrastructure investments under the Gati Shakti initiative are expected to peak during fiscal 2026-2028, aligning with rising demand from industrial expansion and urbanisation. Sectors such as logistics, warehousing, energy and transport are set to benefit from improved connectivity and time-bound project implementation. In the long run, the initiative is expected to play a catalytic role in strengthening India's global competitiveness, improving trade efficiencies and reducing logistics costs from the current 13-14% of GDP to global benchmarks of 8-9%.

Key highlights of Union Budget 2026-27

- The government plans to significantly ramp up public capital expenditure, aiming to reach ₹12.2 lakh crore by the financial year 2026-27. This substantial increase in public investment is expected to drive growth, create jobs, and improve the country's infrastructure.
- The revised tax slabs as well as increased tax rebate limit under the new tax regime, announced during the previous budget, have been maintained, continuing to support middle class consumption.
- The agriculture sector contributes significantly to rural economy, employing 55% of the population. The union budget 2026-27 focuses on four pillars for strengthening agriculture, enhance productivity, improving quality, building climate resilience and supporting sustained farmer income.
- To encourage private sector participation in infrastructure development, the government will establish an Infrastructure Risk Guarantee Fund. This fund will provide a safety net for private developers, mitigating risks associated with infrastructure projects during the development and construction phases.
- India Semiconductor Mission (ISM) 2.0- A new initiative to boost semiconductor production, focusing on equipment and materials, design, and supply chain development.
- The Electronics Components Manufacturing Scheme outlay increased to ₹40,000 crore.
- Dedicated Rare Earth Corridors to be established in Odisha, Kerala, Andhra Pradesh and Tamil Nadu to promote mining, processing, research and manufacturing.
- The Ministry of Road Transport and Highways continued to receive the highest capex allocation (Rs 2.9 lakh crore) followed by the Ministry of Railways (Rs 2.8 lakh crore), rising 8.1% (vs 4.7%) and 10.3% (vs 0%) respectively, next fiscal, reflecting continued commitment to create infrastructure. The two ministries cumulatively have a 46.3.% share in capex next fiscal.
- The Self-Reliant India Fund will receive an additional allocation of ₹2,000 crore. This fund will continue to provide vital support to micro-enterprises, ensuring they have access to the risk capital needed to sustain and grow their businesses.

Impact of GST

GST reforms to accelerate consumption and support domestic sales:

- The government of India has revamped the goods and services tax (GST) structure with three slabs—5%, 18% and 40%

- In the automobile industry, electric vehicles will continue to be taxed at 5%, while other segments have undergone a rate revision to either 18% or 40% (see tables below)

Consumption driven goods:

CATEGORY	ITEMS	OLD GST RATE	NEW GST RATE
Consumer electronics	Air conditioners, dishwashing machines, televisions over 32 inches, monitors, projectors	28%	18%
Food items	Packaged namkeens, sauces, pasta, instant noodles, chocolates, coffee, preserved meat, cornflakes, butter, and ghee	12-18%	5%
Daily usage items	Hair oil, soap bars, shampoos, toothbrushes, toothpaste, tableware, kitchenware, and other household articles	12-18%	5%

Source: Press release document by MoF dated 3 September 2025

- Lower GST on consumer goods, food, and daily-use items to reduce expenditure for households, leaving them with more money to spend. This is likely to boost overall consumption, especially in price-sensitive rural and semi-urban areas
- Higher demand for essentials will increase goods movement, which will benefit small commercial vehicles (SCVs) and light commercial vehicles (LCVs) for last-mile deliveries and intermediate commercial vehicles (ICVs) for mid-mile distribution

CATEGORY	ITEMS	OLD GST RATE	NEW GST RATE
Agriculture	Tractors, harvesters, sprinklers, drip systems, pumps	12%	5%

Source: Press release document by MoF dated 11 September 2025

- The reduction in GST on agricultural inputs such as seeds, fertilisers, and farm equipment will lower costs for farmers, improving affordability
- Lower GST on medical, healthcare and insurance services will reduce household expenses on essential services, effectively increasing disposable income
- This is likely to moderately increase consumption

GST for vehicle pricing

CATEGORY	OLD GST RATE	NEW GST RATE
Buses	28%	18%
LCVs — goods	28%	18%
Medium and heavy commercial vehicles (MHCV) — goods	28%	18%

Source: Press release document by MoF dated 11 September 2025

CATEGORY	OLD GST RATE	NEW GST RATE
Two-wheelers ≤350cc	28%	18%
Three wheelers	28%	18%
Off road vehicles	28%	18%

Small cars (petrol/LPG/CNG)	28% + 1% cess	18%
Small car (diesel)	28% + 3% cess	18%
Larger/luxury cars/SUVs/big cars	28% + 17% cess	40%
Larger/luxury cars/SUVs/big cars	28% + 20% cess	40%
Larger/luxury cars/SUVs/big cars	28% + 22% cess	40%
PV- EV	5%	5%

Source: Press release document by MoF dated 11 September 2025

- Lower GST led to reduction in prices of two-wheelers, making it affordable for youth and professional and lower middle-class households
- Two-wheelers are the primary mode of transport in rural and semi-urban areas. The price reduction will directly benefit farmers, small traders and daily wage earners
- It is expected to boost the saving of the consumers through reduced cost and EMIs for two-wheeler loans, thus providing a fillip to vehicle demand
- By reducing the effective rate on small cars to 18% and capping larger vehicles at 40%, the government has simplified what was earlier a mix of GST plus compensation cess
- Cars in the affordable segment became cheaper, encouraging first time buyers and increasing household mobility
- No more cess on any of these car categories. The compensation cess (which added up significantly in luxury/large vehicle segment) is removed under the new structure
- Reduced GST is expected to drive higher car sale, and it will provide an added push to industry sales, supporting PV industry and the auto component industry

The auto component industry is also set to benefit from the revised GST rates, which will simplify the tax structure and reduce compliance burdens for manufacturers, dealers and suppliers. Previously, disparate GST rates of 18% and 28% on various auto parts led to disputes and complexities. The new rates will lower input costs for manufacturers, reduce working capital requirements and drive demand for new vehicles.

CATEGORY	OLD GST RATE	NEW GST RATE
Auto component	28%	18%

Source: PIB.gov published on 8 September 20

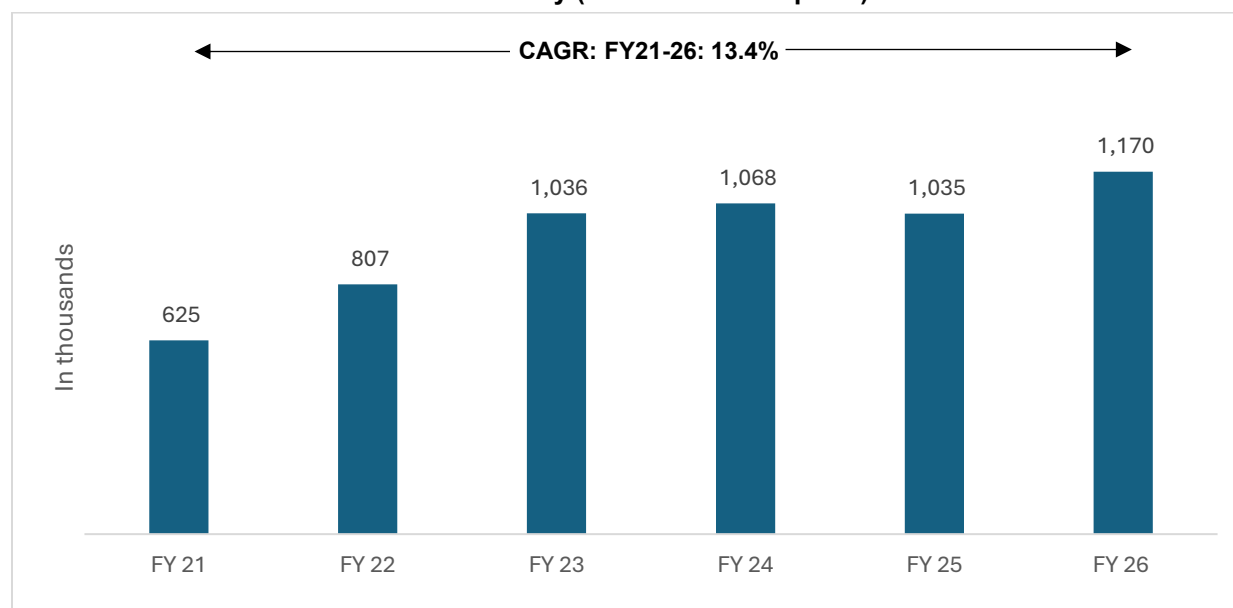
Module II- Review and Outlook of end-use industries

Review and outlook of the Indian commercial vehicle industry

Historic Production Development (FY 21-26)

India is the third-largest commercial vehicle market in the world, with total production volumes recording 1.17 million units in fiscal 2026. The volumes have consistently been over 1 million units over the past four fiscals, indicating healthy demand in the market, albeit steadily. The market logged a CAGR of 13.4% over the past five years, driven by an e-commerce surge in the country and the increasing number of infrastructure development projects. The industry particularly in fiscal 2026, grew at 13% over fiscal 2025 and this underscores the sector's resilience and its critical role as a barometer for India's broader macroeconomic expansion and industrial activity.

Historic Production trend in the CV industry (domestic and exports)



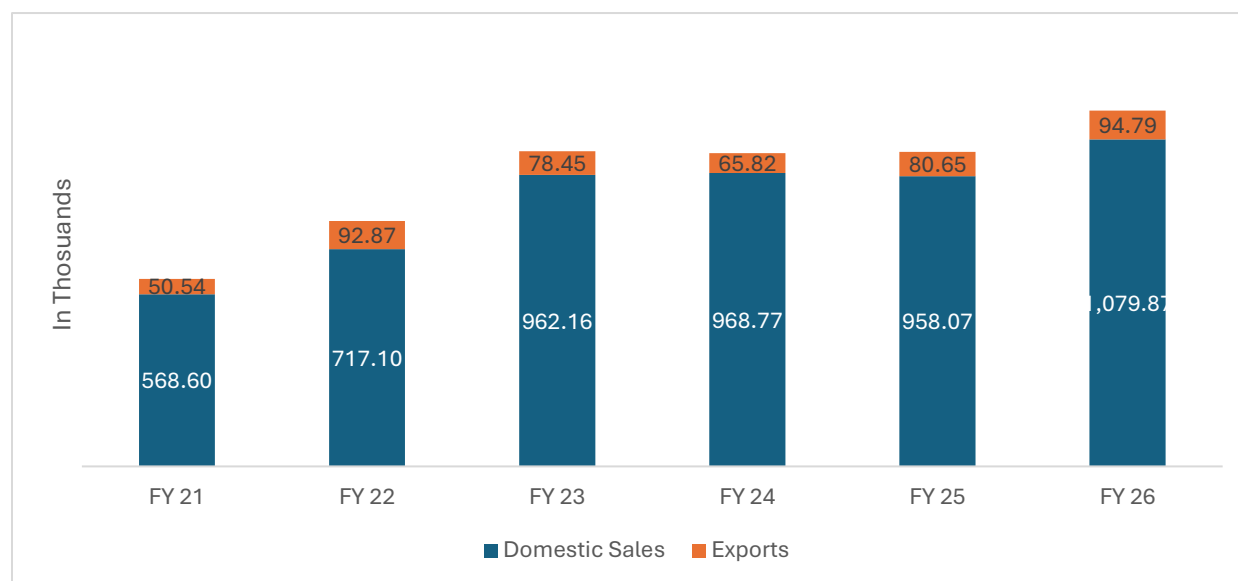
Note: Data includes domestic sales and exports of LCV – light commercial vehicles, IMHCV – intermediate medium and heavy commercial vehicles and buses, and excludes Daimler

Source: SIAM, Crisil Intelligence

Exports, which form 8% of the overall CV industry rose to 94,793 in fiscal 2026 from 50,538 units in fiscal 2021 at a CAGR of 13.4%. The growth was led by increasing demand for Indian commercial vehicles in emerging markets, strategic investment in localisation of products and rising competitiveness of Indian OEMs on cost and quality parameters.

After consecutive drops in fiscals 2023 and 2024 on the high base of fiscal 2022, industry exports rose at a healthy pace of 22.5% in fiscal 2025 and further grew by 17.5% in fiscal 2026.

Split by domestic sales and exports



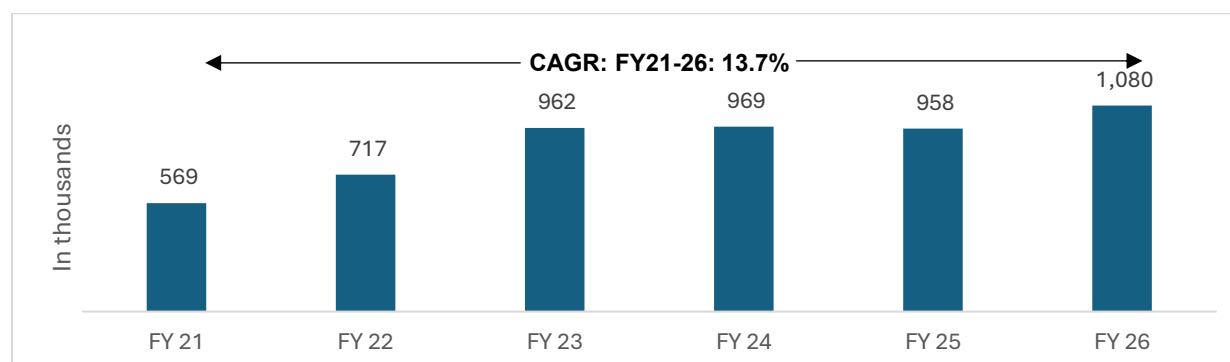
Note: Analysis excludes Daimler as the data for the company is not available in SIAM

Also please note that there will be a slight mismatch between the numbers in the above chart and production numbers which is due to inventory

Source: SIAM, Crisil Intelligence

Domestic Sales

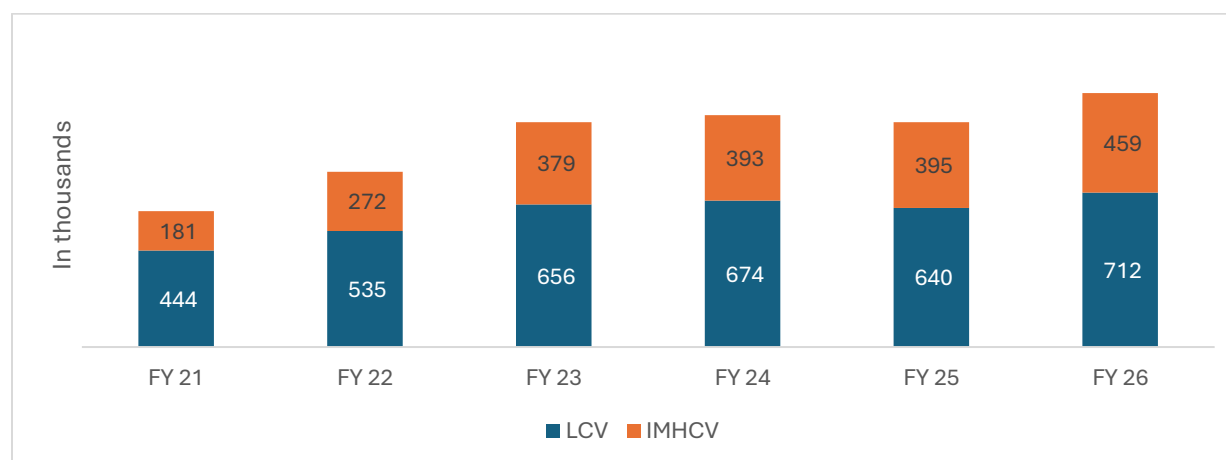
The domestic segment, which contributes more than 90% of the industry logged a CAGR of 13.7% between fiscals 2021 and 2026. The industry witnessed a 20.76% drop in fiscal 2021, led by Covid-induced restrictions. However, the segment rebounded at a CAGR of 13.7% between fiscals 2021 and 2026, with resumption in economic activity and improved mobility.



Note: Analysis excludes Daimler as the data for the company is not available in SIAM

Source: SIAM, Crisil Intelligence

Production split by segment



Note: Analysis excludes Daimler as the data for the company is not available in SIAM and includes buses of the respective segments

Source: SIAM, Crisil Intelligence

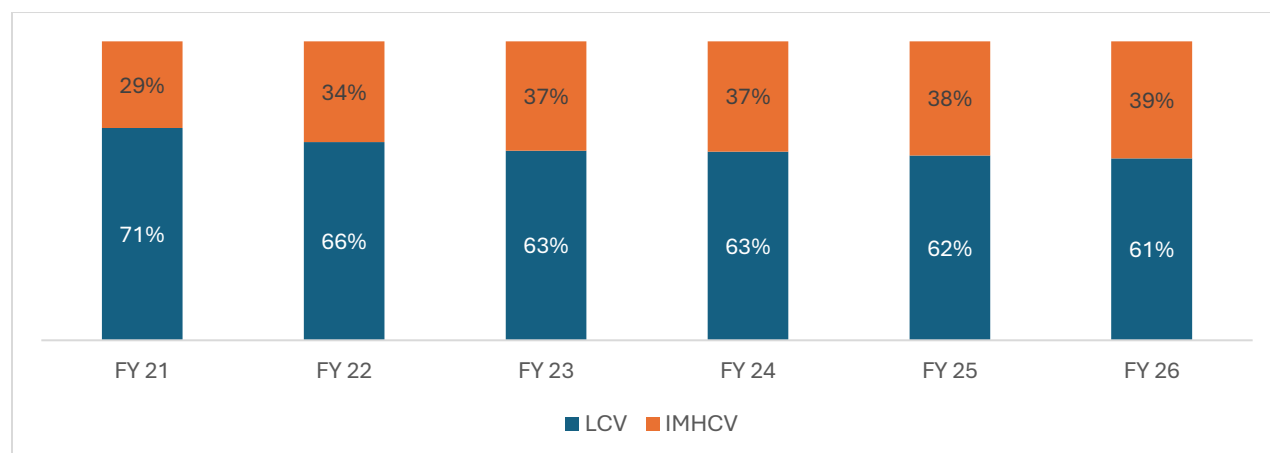
The market is broadly split into LCV (gross vehicle weight less than 7.5 tonne), IMHCV (more than 7.5 tonne).

LCV segment grew by 11.2% in fiscal 2026, after a decline in fiscal 2025 by 5%. The resurgence in FY26 was primarily underpinned by stable end-use sectors such as agriculture, e-commerce, consumer goods, and a broader revival in construction. A primary growth catalyst was the implementation of GST 2.0, which reduced vehicle acquisition costs by ₹80,000 to ₹1,00,000. This improved affordability lowered EMIs, enhanced asset quality trends, and revived lender confidence, thereby easing credit access for first-time buyers and small fleet operators. Furthermore, product interventions, including alternate fuel options and new launches like the Tata Ace LNT, Ace Pro, Ashok Leyland Saathi, and Euler models, expanded customer choice and witnessed strong pan-India traction. Demand in the sub-1 tonne and pickup categories was consistently bolstered by captive-led last-mile logistics and a healthy rabi harvest. Additionally, the discontinuation of electric three-wheeler subsidies prompted fleet operators to pivot toward electric sub-1 tonne models for intra-city deliveries, while the 3.8 tonne category steadily emerged as a standout growth segment due to its superior payload and loading area dynamics.

The IMHCV industry recorded a robust expansion of 16% in fiscal 2026, demonstrating a sharp acceleration compared to the marginal growth of 0.3% witnessed in fiscal 2025. This was supported by strong growth in ICV and MCV segments, primarily underpinned by the versatility and strong linkage with industrial, utility, and bulk material movement. Intermediate and Medium Commercial Vehicles benefited from stable tender-led demand, institutional fleet requirements, and broad cargo relevance across e-commerce, liquid petroleum gas, containers, cement, and raw material transportation. The implementation of GST 2.0 stimulated consumption growth in fast-moving consumer goods and durables, further driving market load transportation. Additionally, a favorable agricultural outlook and an increasing preference for compressed natural gas vehicles supported this category, with the Intermediate Commercial Vehicle segment poised for accelerated growth as it increasingly caters to traditional medium commercial applications through 18 to 18.49 tonne models. Concurrently, Heavy Commercial Vehicles, including multi-axle vehicles and tractor-trailers, witnessed a structural shift toward higher gross vehicle weight configurations, particularly 48 tonne and 55 tonne models, as fleet operators prioritized payload economics and fleet productivity. Demand remained robust across core sectors, including

mining, coal, steel, cement, and car carriers. Across the broader segment, the GST 2.0 framework lowered acquisition costs and equated monthly installments, unlocking replacement cycles that had been delayed by one to two years.

Production split by segment (in %)

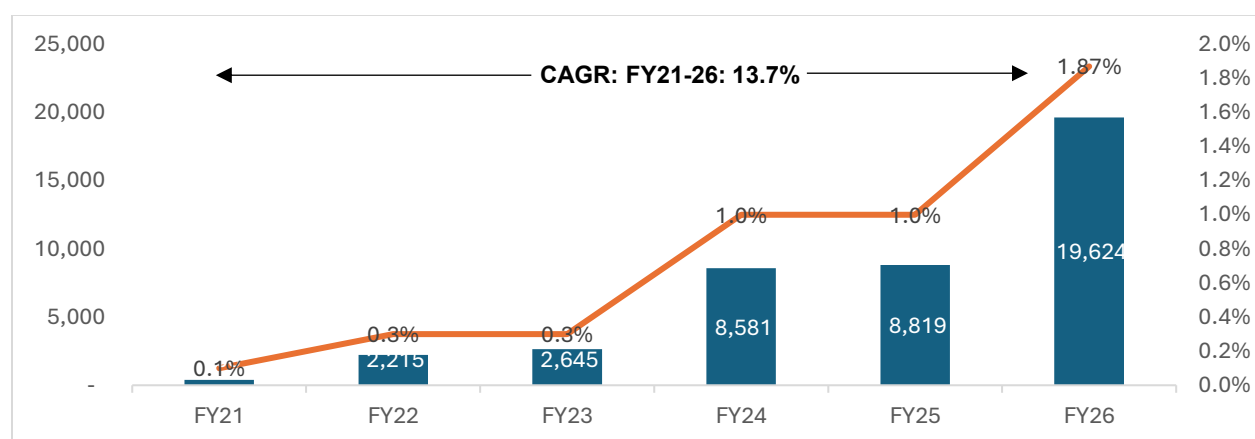


Note: Analysis excludes Daimler as the data for the company is not available in SIAM

Source: SIAM, Crisil Intelligence

Electrification in the domestic commercial vehicle industry

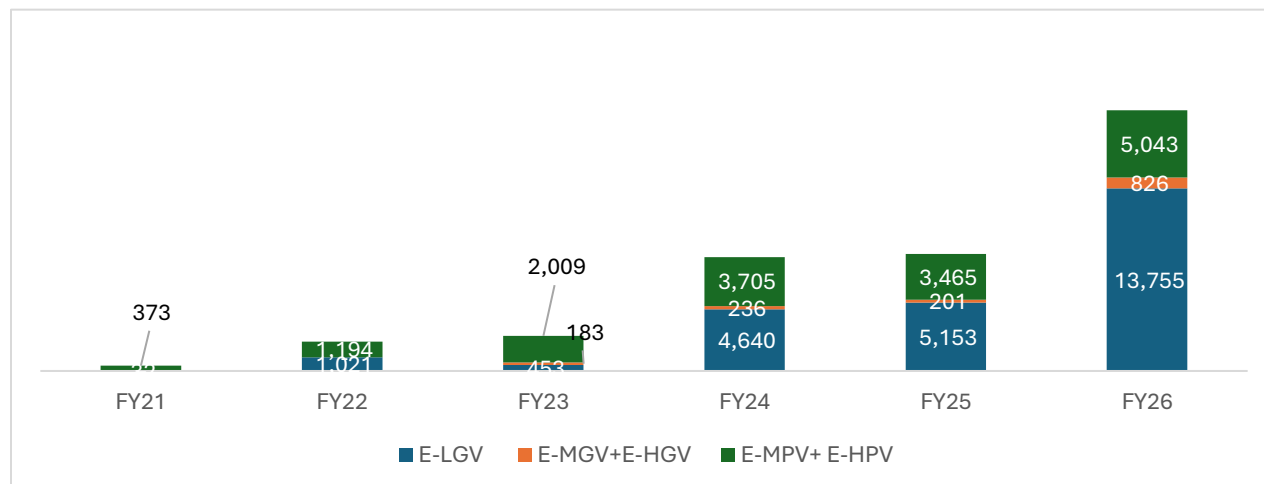
Electrification in the Commercial Vehicle Industry has been on the slower side as compared to other vehicle segments due to higher up-front costs, lack of charging infrastructure on key long-distance corridors, etc. Within domestic CVs, Buses were the first segment to be electrified, followed by LCVs. During the last 5 years, EV penetration within overall CVs increased from 0.1% in fiscal 2020 to almost 1.87% by fiscal 2026.



Note: The following segments are considered under CV- Light Goods Vehicle (LGV): 0-7.5T GVW; Medium Goods Vehicle (MGV)/Medium Passenger Vehicle (MPV): 7.5-12T GVW; Heavy Goods Vehicle (HGV)/Heavy Passenger Vehicle (HPV): >12T GVW

Source: VAHAN

EV sales by segment

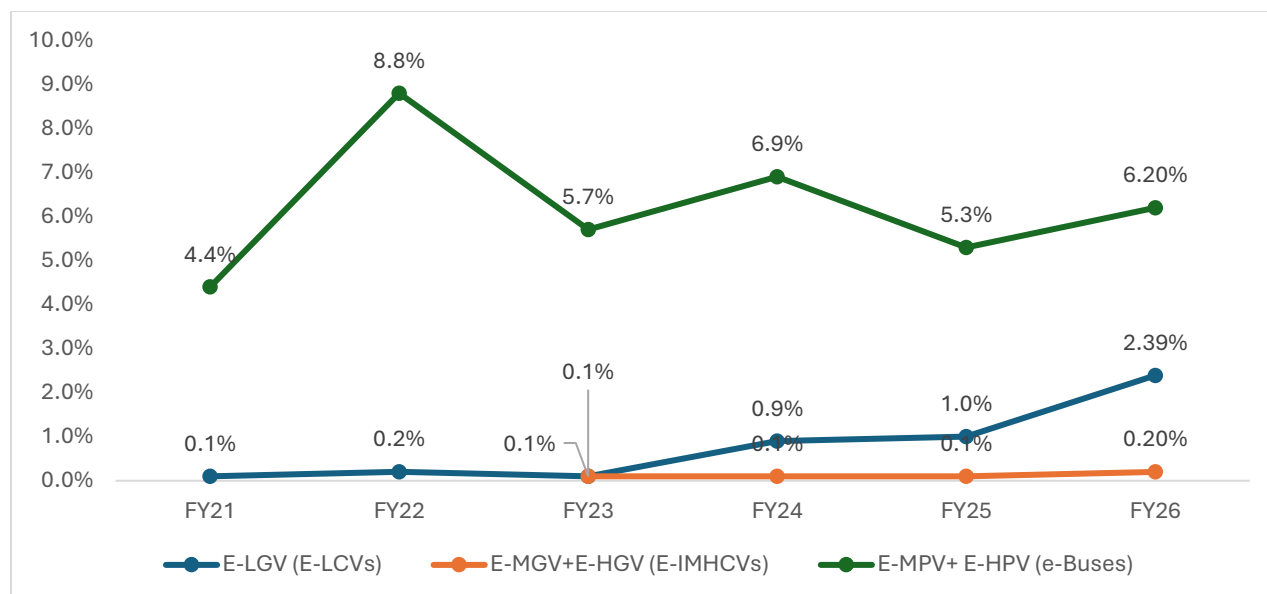


Note: Light Goods Vehicle (LGV): 0-7.5T GVW; Medium Goods Vehicle (MGV)/Medium Passenger Vehicle (MPV): 7.5-12T GVW; Heavy Goods Vehicle (HGV)/Heavy Passenger Vehicle (HPV): >12T GVW

Source: VAHAN

The electric Light Commercial Vehicle (e-LCV) segment witnessed exponential growth, with volumes surging from 5,153 units in fiscal 2025 to 13,755 units in fiscal 2026, translating to a remarkable year-on-year growth of 167%. This accelerated adoption is primarily driven by the increasingly favourable Total Cost of Ownership (TCO) for intra-city operations, alongside supportive government policies/subsidies, and the expanding charging infrastructure network. Furthermore, the aggressive push by e-commerce, quick-commerce, and FMCG companies to meet their ESG (Environmental, Social, and Governance) targets has significantly catalysed the deployment of e-LCVs in last-mile delivery fleets

EV penetration



Note: Vahan figures exclude Telangana retails

Source: SIAM, Vahan, Crisil Intelligence

Within the domestic commercial vehicle space, the bus segment emerged as the first to be electrified, led primarily by State Transport Undertakings (STUs) adopting electric buses through Gross Cost Contract (GCC) models. This early adoption was strongly supported by central and state government incentives and procurement programs, creating a structured demand base for e-buses, and via improving TCO of e-buses driven by reduction in the battery prices.

Buses have the highest penetration of EVs within the CV industry. The penetration increased to 6.2% in fiscal 2026 from 4.4% in fiscal 2021. The penetration increased to 6.2% in fiscal 2026 from 5.3% in fiscal 2025. The industry declined in fiscal 2025 and it was a predictable market correction following a policy-driven anomaly in the prior year. The 6.9% in fiscal 2024 resulted from a high-volume rush of tendering and registrations as operators moved urgently to secure FAME-II capital subsidies before the scheme's final closure in March 2024.

e-LCVs currently has a penetration of 2.4% in fiscal 2026, with an increase from 1% in fiscal 2025. The industry grew by 167% in the previous fiscal and it is expected to continue as this trend is largely driven by the suitability of LCVs for electrification, as these vehicles typically operate over shorter distances, minimizing concerns around battery range and charging infrastructure. Furthermore, electric LCVs (e-LCVs) offer a compelling value proposition for sectors like e-commerce and last-mile delivery, where they help reduce operating costs and align with broader sustainability goals

In the heavy goods vehicle segment, which includes vehicles with a GVW of over 12 tons, the adoption of electric vehicles has been slower compared to light vehicles. This is primarily due to the need for larger batteries, typically with a capacity of over 250 kWh, which significantly increases the cost of the vehicle. Furthermore, these vehicles require fast charging infrastructure, which can charge the vehicle quickly, but the charging process itself can still take a considerable amount of time, typically ranging from 1.5 to 4 hours, depending on the power capacity of the charging station.

Despite these challenges, electrification is starting to gain momentum in certain applications where intermittent charging throughout the day is feasible. For instance, OEMs are setting up charging stations suitable for heavy trucks in captive customer locations and along prominent highways. This has led to the adoption of electric

vehicles in applications such as ports, mines, and specific highway routes, where trucks operate on fixed routes and in large numbers, such as mine-to-factory-to-mine routes. Several OEMs, including Montra Electric, Propel, Ravindra Energy, Blue Energy, Tata Motors, and Ashok Leyland, have launched electric models in the heavy truck space, specifically in the tippers and tractor-trailer segments.

Policies driving the adoption of EVs

The Government of India and several states together have introduced fiscal and non-fiscal incentives to support the adoption of electric mobility. These include tax breaks, subsidies and lower registration charges. Various policies have been launched to strengthen the component and charging infrastructure.

CPM e-Bus Sewa Scheme

The PM e-Bus Sewa Scheme is an initiative of the central government to promote electric mobility in public transportation. Under this scheme, the government aims to deploy 50,000 electric buses.

FAME I and II

As part of the National Electric Mobility Mission Plan 2020, the Department of Heavy Industry introduced the FAME scheme in 2015 to promote EV manufacturing and adoption.

During Phase I, it focused on creating demand for EVs through incentives and grants for various vehicle segments and supported about 2.78 lakh EVs. The FAME II scheme was approved with an outlay of Rs 10,000 crore, which was later enhanced to Rs 11,500 crore. It aimed to support 7,000 e-buses, 5 lakh electric three-wheelers, 55,000 electric four-wheelers (commercial purposes) and 10 lakh electric two-wheelers (commercial and private).

FAME II subsidy for buses dependent on battery size

Under the FAME II incentive, the government provided a subsidy of Rs 20,000 per kWh of battery used in an electric bus. These needed to be advanced batteries with specific energy density of at least 70Wh/kg and a cycle life of at least 1,000 cycles. Of the Rs 11,500 crore demand subsidy under FAME II, about 40% was for buses.

For electric small commercial vehicles (SCVs), the government provided subsidies of Rs 10,000 per kWh of battery. It also mandated a minimum range of 140 km and maximum ex-factory price of Rs 15 lakh.

PM E-DRIVE

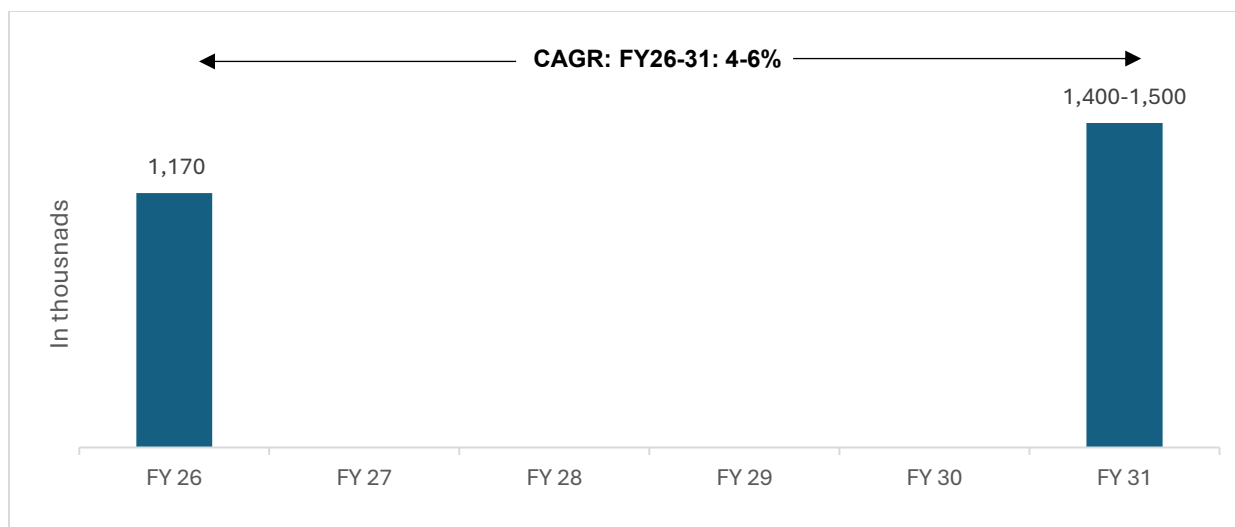
The PM E-DRIVE scheme aims to provide support for 14,028 e-buses, 2,05,392 e-three-wheelers (L5), 1,10,596 e-rickshaws and e-carts, and 24,79,120 e-two-wheelers. The scheme also supports e-trucks, e-ambulances, EV public charging stations and upgrades to testing agencies

CGST 2.0

The rationalisation of GST rates in September 2025, which reduced the tax rate on commercial vehicles from 28% to 18%, led to a 7-8% decrease in vehicle prices. Although this change does not account for potential cost savings from lower GST rates on components that automotive component manufacturers may pass on to original equipment manufacturers (OEMs), it is expected to have a positive impact on the market.

Outlook of Indian Commercial Vehicles Industry (FY26-31)

With increasing infrastructure development and rising freight demand from multiple sectors, the Indian CV industry is poised for long-term expansion, projected to grow at a CAGR of 4-6% over the next five years, from 1.17 Mn units in fiscal 2026 to ≈1.4-1.5 Mn units by fiscal 2031

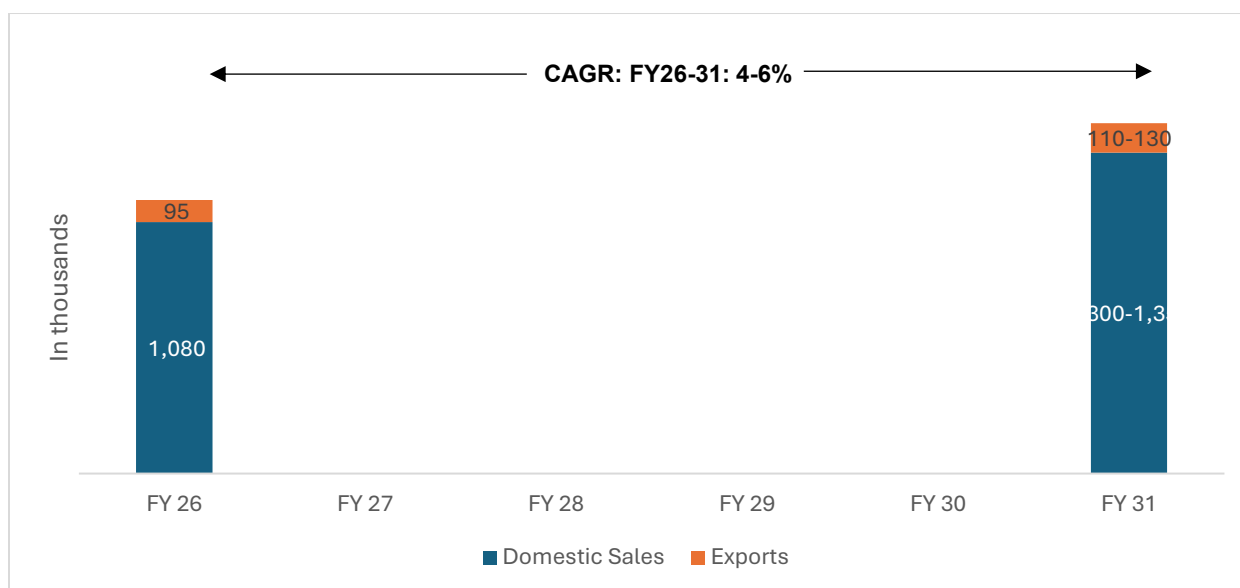


Domestic sales are expected to grow at a CAGR of 4-6% and the exports segment is expected to grow at a CAGR of 5-7% during the period between fiscal 2026 and 2031.

On the exports front, manufacturers are directing their investments into expanding presence to other Asian countries from neighbouring countries such as Bangladesh, Nepal, and Sri Lanka to Africa and the Middle East. Domestic players are also considering setting up assembly operations across multiple markets. Also, going forward, new product line-ups and technology upgradation will allow domestic players to enter relatively advanced markets of southeast Asia.

Exports from India are expected to grow steadily over the forecast period, with volumes increasing to 110,000-125,000 units by fiscal 2031 from ~95,000 units in fiscal 2026, at a CAGR of 5-7%. This growth is likely to be supported by increasing demand for Indian commercial vehicles in emerging markets, strategic investment in localisation of products and rising competitiveness of Indian OEMs on cost and quality parameters.

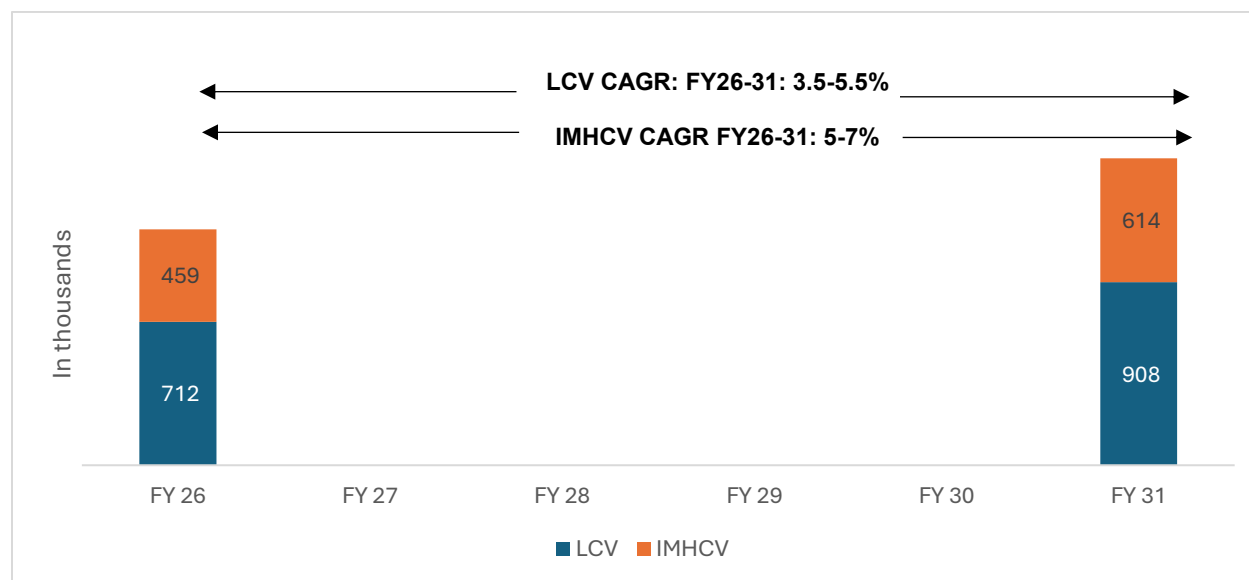
Split by domestic sales and exports



Split by vehicle segments

LCV segment including LCV buses segment, is expected to clock a CAGR of 3.5-5.5% from fiscal 2026 to 2031. During fiscals 2021 to 2026, the industry exhibited a 9.9% CAGR. Demand sustained despite the impact of the pandemic because of the expansion of e-commerce activity during the period.

In fiscal 2027, the LCV segment is projected to grow 3-5%, driven by increased economic and commercial activities. This growth is expected to be driven by replacement volumes from healthy sales over fiscals 2017 to 2019 and the resumption of government spending to usual levels. Additionally, the lowering of the repo rate, revision of GST structure and higher loan disbursements are expected to contribute to this growth.



The IMHCV segment has seen a fluctuating yet resilient performance in recent years. In fiscal 2025, growth slowed, reflecting the impact of economic headwinds and supply-side challenges, but the industry grew by 16% in fiscal 2026, indicating strong demand.

The sustained push for infrastructure development, increased logistics digitisation and policy-driven fleet modernisation is expected to shape the segment-wise trends in the coming years. The increased construction and mining activity will be supported by a 9-11% higher budgeted construction capex.

The IMHCV segment is expected to clock healthy growth with a projected CAGR of 5-7% from fiscals 2026 to 2031. Long-term IMHCV sales are likely to be driven by improving industrial activity, consistent agricultural output and the government's continued emphasis on infrastructure development, among other factors. However, volume growth may be limited by efficiencies gained from the implementation and rationalisation of the GST, the development of improved road infrastructure and the commissioning of the dedicated goods corridors. Nonetheless, the industry remains on a promising growth trajectory.

The buses segment (both LCVs and MHCVs) growth is expected to be gradual as STUs and private operators incrementally replace aging bus fleets and respond to growing urban and intercity transportation needs. Central and state-led procurement schemes are expected to boost the momentum in the segment, on the back of a stronger push for cleaner public transport. However, slower penetration of electric buses outside STUs and higher acquisition costs could result in modest growth compared with goods vehicles.

Key Growth Drivers for domestic and exports

Increasing freight rates to aid in materialization of deferred demand

In fiscal year 2026, fuel prices constituted approximately 55% of transporter costs, exerting a considerable influence on their overall profitability. During this period, diesel prices remained stable. Concurrently, freight rates also rose by an estimated 12%, signalling improved transporter profitability and heightened demand for freight services. These favourable factors are expected to boost Commercial Vehicle (CV) sales, as the industry capitalizes on the increased demand in the transportation sectors.

Easier Financing Options Enhancing Truck Sales Momentum

Access to vehicle financing has improved notably over the past few years, driven by increased participation from banks, NBFCs, and captive financing arms of OEMs. Financial institutions have started offering customized loan products with longer repayment tenures, lower EMIs, and flexible down payment structures. The government's initiatives to formalize small fleet operators and improve their creditworthiness through digital lending platforms and GST-linked profiling have also enhanced access to credit. As a result, first-time buyers and small fleet owners are finding it easier to purchase CV, thereby supporting demand growth in the sector.

Stable agricultural output

Stable agricultural output continues to serve as a critical growth driver for the broader rural economy and the CV industry. CRISIL projects a 3 to 4 % growth in agricultural gross value added over fiscal 2026 to 2031, building upon a steady 2 percent growth recorded in fiscal 2024. Moving forward, the progress and spatial distribution of monsoon rainfall will play a pivotal role in the current kharif cycle, serving as a key monitorable for rural demand, particularly for two-wheelers and tractors. To navigate climatic uncertainties such as the El Nino phenomenon, which poses inherent risks to crop yields, the government has proactively prioritized agricultural resilience. These strategic interventions are designed to mitigate weather-related disruptions, ensure long-term food security, and thereby reinforce the foundational demand for drivers within the rural ecosystem.

Healthy industrial growth

The Indian industry's gross value added (GVA) had been growing rapidly, in line with the GDP averaging ~averaging around 6% between fiscals 2020 and 2026. After consecutive weak fiscals of 2020 and 2021 due to the COVID-19 outbreak, industrial GVA is estimated to have grown by approximately 6.4% on-year in fiscal 2026. Over the next five-year period (fiscal 2026-2031), industry GVA is expected to be robust driven by the government's focus on 'Make in India' with the stated aim of the government to push up the share of Manufacturing in India's GDP from 17% to 25%. Moreover, improvement in infrastructure and higher expected corporate expenditure is likely to support the capex cycle going forward post-fiscal 2024. India's ambitious infrastructure development plans, including the Bharatmala Pariyojana and Sagarmala programs, are expected to drive commercial vehicle demand during fiscal 2026 to fiscal 2031, as the resulting increase in construction and logistics activities boosts demand for heavy and medium commercial vehicles.

Focus on infrastructure and higher mining production to bolster tipper demand

Over the next five-year period (fiscal 2026-2031), industry GVA is expected to be robust driven by the government's focus on 'Make in India' with the stated aim of the government to push up the share of Manufacturing in India's GDP from 17% to 25%. The budgeted capex allocation for infrastructure ministries for fiscal 2024 has shown a 28% increase over fiscal 2023 RE (revised estimates) to Rs. 18.6 lakh crore. Execution

by the National Highways Authority of India (NHAI) will reach up to ~14-15 km/day in fiscal 2027, as against ~11 km/day in fiscal 2021, aided by the Bharatmala project. Projects such as Sagarmala and investments in various irrigation projects will further drive MHCV demand. We expect coal production to expand at ~4.5-5.5% CAGR between fiscals 2024 and 2029, while iron ore mining will also likely grow at ~3.5-4.5% CAGR during this period, aiding tipper demand.

Scrappage policy

MoRTH, in August 2018, considered incentivizing the scrapping of vehicles sold before April 2005 (15 years old). After deliberations on the modalities on implementation of the norm, the government currently aims to promote vehicle scrapping by exempting registration charges for truck purchases made after scrapping older trucks. To incentivize scrappage of older vehicles, the government has increased the registration charges for older vehicles and increased stringency of fitness tests. These will entail higher costs for owners of older vehicles. Hence, by disincentivizing the ownership of older vehicles, the government expects the scrappage of older vehicles to increase. We expect the impact of the norms to be limited on additional scrappage (apart from vehicles scrapped in the normal course of business). If, through higher incentives from the government and OEMs, transporters can be incentivized to scrap vehicles older than 15 years, we expect 6,00,000-6,50,000 MHCVs to be available for scrapping. Although translation of the same into demand for new CVs will be a monitorable based on implementation and incentivization levels.

Private final consumption expenditure (PFCE)

LCVs are primarily used for last-mile transport and redistribution of commodities. PFCE is a good indicator of domestic consumption demand, and accounts for more than 90% of the LCV goods tonnage segment. Apart from the usual freight demand, an increase in rural consumption and urban expenditure boosts demand for smaller vehicles to transport consumer goods. Moreover, a rise in consumption of non-food items, consumer durables and fast-moving consumer goods fuels demand for LCVs.

PFCE is expected to continue its momentum and clock a CAGR of 6.5-7.5% from fiscals 2025 to 2030, which is expected to support the growth of the LCV segment.

Increasing adoption of the hub-and-spoke network

The road transport industry is gradually moving towards the hub-and-spoke distribution model, wherein industries have large hubs in major regions. Goods are consolidated at these hubs and sent to several touch points (spokes) in the hinterland. This is expected to provide a continued push to LCV demand.

Impact of regulatory changes on domestic commercial vehicles sales

ADAS & AC Mandates

The Ministry of Road Transport and Highways (MoRTH) is prioritizing road safety and driver welfare, which have historically been neglected in the Indian CV space.

Starting April 1, 2026, newly introduced models of trucks and buses (N2, N3, M2, M3 categories) must be equipped with Advanced Driver Assistance Systems (ADAS). This includes Emergency Braking (AEBS), Driver Drowsiness Warning (DDAW), and Blind Spot Information Systems. This will significantly increase the BOM (Bill of Materials) cost. For fleet operators, the perceived impact is a reduction in insurance premiums and accident-related downtime, though the initial acquisition cost will rise.

All N2 and N3 category trucks must have air-conditioned cabins. This moves the market away from cowl chassis toward factory-built cabins (fully built units). It improves driver retention in a market facing a severe driver shortage.

Emission Standards: BS-VII and Beyond

While India only recently transitioned to BS-VI (OBD-II), the next leap is already on the horizon. BS-VII Norms (Expected 2026–2028) which is expected to be modeled after Euro 7, these norms will likely be fuel-agnostic (same limits for petrol and diesel). A critical addition is On-Board Monitoring (OBM), which tracks real-world emissions throughout the vehicle's life, not just at the time of sale. BS-VII will make diesel after-treatment systems (ATS) extremely complex and expensive. This is expected to trigger a segment shift where Light Commercial Vehicles (LCVs) migrate toward Electric and Heavy Commercial Vehicles (HCVs) move toward LNG or Hydrogen to avoid the high compliance costs of diesel.

CAFE/CAFC Norms for CVs

A new draft released on 28 July 2025 proposes taking fuel efficiency norms into Phase 2, where in model specific fuel efficiency norms will be replaced by CAFE norms. The proposed implementation window is from 2027 to 2032. Some of the key proposed aspects are mentioned below.

1. **Shift from per-vehicle Minimum Energy Performance (MEP) to fleet-wide CAFE standard:** Previously, every type /mode of vehicle had different efficiency requirements. But the new proposal says, efficiency targets need to be met on average across all models sold by the manufacturer cumulatively.
2. **Stricter target:** OEMs will now have to ensure 30% fleet-wide improvement in fuel efficiency compared to 2022-23 levels. Earlier fuel efficiency varied by model.
3. **Scope expanded:** Covers light, medium, and heavy-duty vehicles, across all fuels and not just diesel which was the case until now. Previously, it covered only medium and heavy-duty vehicles.
4. **Super-credits introduced:** under this concept, for every Hydrogen and EV vehicle sold, the manufacturer gets a certain number of credits,

OEMs will be forced to balance their portfolio. To meet fleet-average CO2 targets, they will need to sell a specific percentage of Zero Emission Vehicles (ZEVs). This creates a Super Credit system where one electric truck sold can offset the emissions of multiple diesel trucks, accelerating the push for electrification by manufacturers.

Modernization: Scrappage Policy

Commercial vehicles older than 15 years must undergo mandatory fitness tests; failure results in de-registration. Government-owned CVs older than 15 years are being scrapped starting 2024–25. This policy will create a replacement cycle tailwind. As enforcement tightens inefficient CVs will need to be replaced, providing a steady platform for new vehicle demand through 2030.

Alternative Fuels: Green Hydrogen & LNG

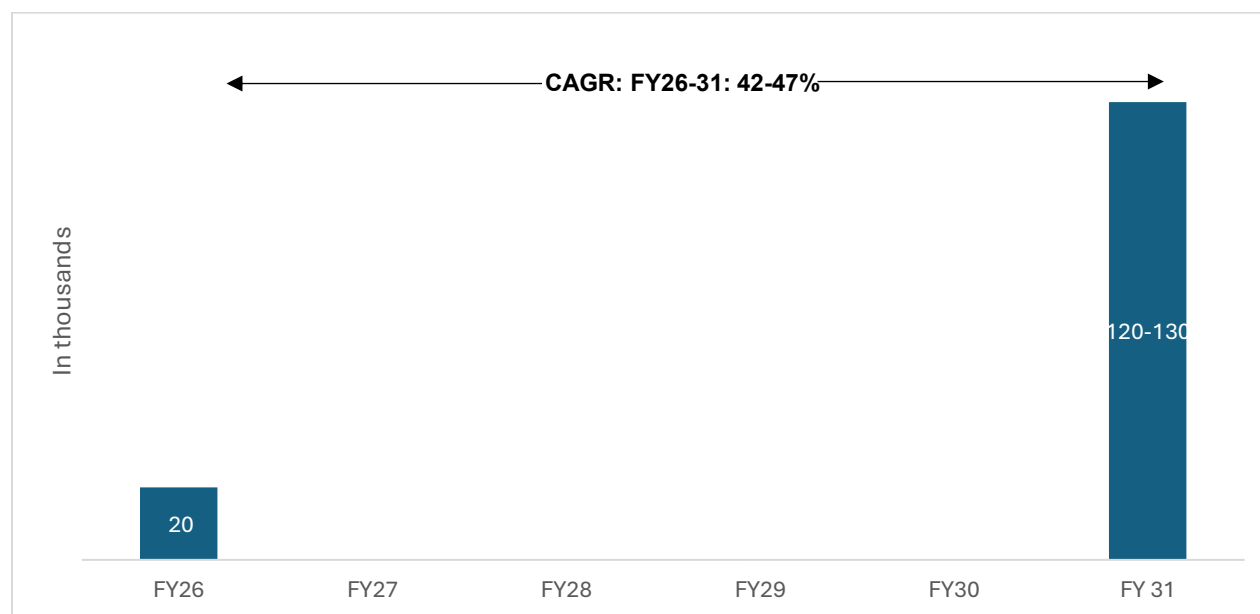
National Green Hydrogen Mission targets 1,000+ hydrogen-powered heavy trucks on the road by 2030. The government is incentivizing the setup of LNG stations every 200–300 km on major highways. For long-haul (1,000+ km) applications where batteries are too heavy, LNG and Hydrogen are positioned as the primary diesel alternatives.

Estimated Penetration of Electric commercial vehicles by 2030

The Government of India has undertaken several steps to ensure proliferation of electric vehicles, such as Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME I and FAME II), Phased

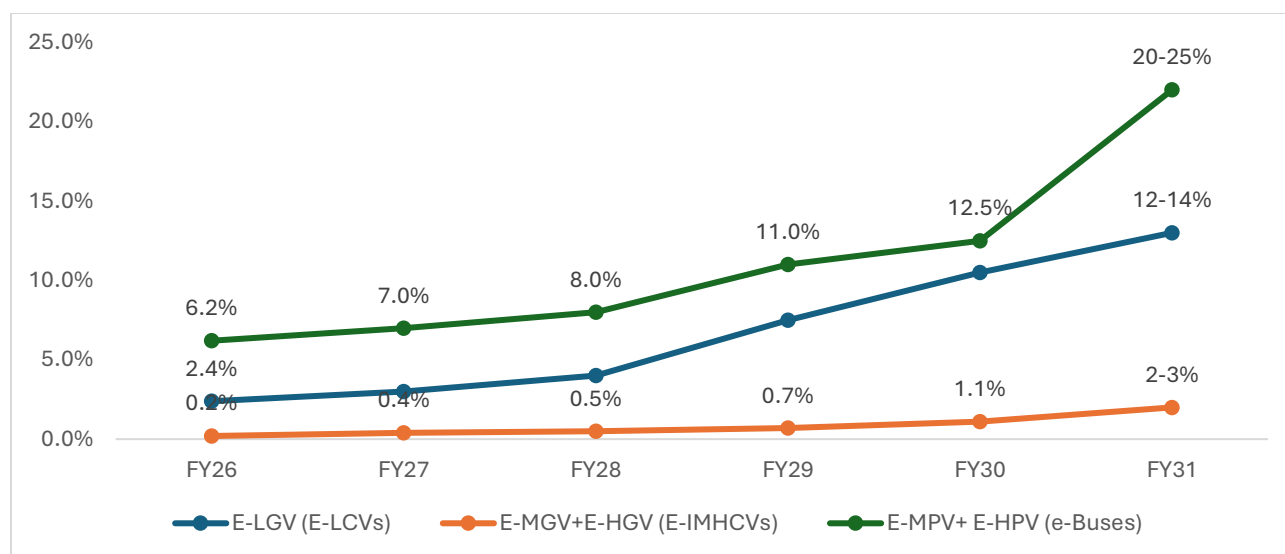
Manufacturing Program (PMP) and Production Linked Incentive (PLI) to name a few. The same has been supported by lucrative state EV policies, which a few progressive states have released.

Currently, most EVs used in the commercial segment as goods carriers are three-wheelers and LCVs, and they are picking pace. However, as the cost differential between electric and diesel vehicles start reducing, CRISIL expects new models to be launched, which will drive sales in the segment as the third-mile logistics and local distribution of goods are well suited applications for electric vehicles.



Due to the Government support through FAME and focus on quicker adoption of EVs in public transport, there has been significant increase in electric bus sales in the last couple of years. Further, through the introduction of PM eBus Sewa scheme government aims to augment the city bus operations using 10,000 e-buses through Public-Private Partnership (PPP) model across India. The Scheme will support bus operations for 10 years and would have an estimated cost of Rs.57,613 crore, out of which support of Rs.20,000 crore will be provided by the Central government. Operational profile of buses with fixed routes and regular stops makes them suitable for charging at pre-determined intervals and specific locations.

The penetration is expected to reach 20-25% in buses segment and 12-14% in LCV segment by fiscal 2031, while the penetration in IMHCV segment is still expected to be low at 2-3% by 2030. Electric bus registrations have skyrocketed in the past few years owing to adoption by STUs as well as government incentives. The price of an electric bus is considerably higher than that of a diesel-powered bus running. Thus, subsidies would be a key driving factor for electrification of STU buses. A large part of the STU intra city buses is expected to be electric by fiscal 2030.



Review and Outlook of Off-Highway Vehicles

Off-highway vehicles are engineering machines and vehicles used for construction (industrial & infrastructure), agriculture, mining, waste management, and logging activities. They are also used to prepare the ground, excavation, haulage of material, and dumping/laying in a specified manner. The various types of machines used are backhoe loaders, excavators, wheeled loaders, skid steer loaders, graders, cranes, dozers and compactors.

Equipment Category

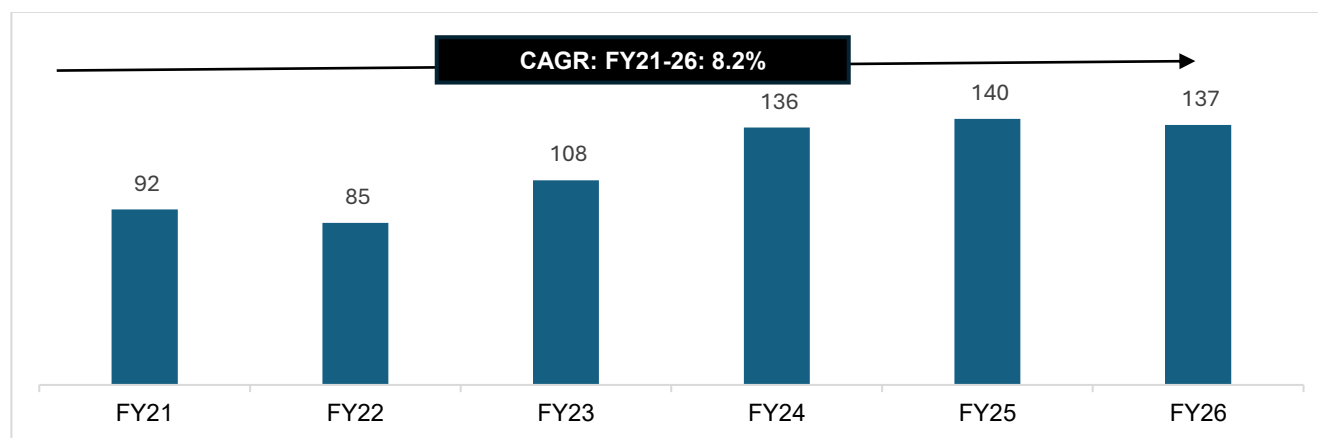
Earthmoving Equipment	Material Handling Equipment	Road Construction Equipment	Material Processing Equipment	Concrete Equipment
Backhoe loaders	Pick & Carry Cranes (Hydra Cranes)	Tracked Pavers	Compressors (Automatic/Diesel/Electric Portable; Diesel Skid)	Batching Plants
Skid Steer loaders	Pick & Carry Cranes (Hydraulic Cranes)	Wheeled Pavers	Static Crushers	Self Loading Concrete Mixers
Track Loaders	Pick & Carry Cranes (Next Gen Cranes)	Single Drum Rollers (Soil Compactors)	Track Crushers	Concrete Mixers (Transit Mixers)
Wheeled Loaders	Lorry Loader Cranes	Double Drum Rollers (Tandem Compactors)	Wheeled Crushers	Stationary Concrete Pumps
Track Type Tractors/ Crawler Dozers	Truck Cranes	Pneumatic Tyre Rollers	Roll Crusher	Mobile Line Pumps
Wheeled Dozers	Crawler Cranes	Asphalt Batching Plants	Screeners (Static/Track mounted/Vibrating)	Boom Pumps
Crawler Excavators	All Terrain Cranes	Asphalt Finishers	Air Classifiers	Shotcrete
Wheeled Excavators	Rough Terrain Cranes	Milling Track	Wet Classifiers / Washing System	Slipform Pavers
Motor Graders	Fixed Tower Cranes	Milling Wheel	Grizzly Feeder	Fixed Form Pavers
Off Highway Dump Trucks	Mobile Tower Cranes		Pan Feeder	
Pipe Layers	Tele Handlers			
	Reach Stackers			

Source: ICEMA

Off-highway vehicles have an average life of about 7-8 years, depending on frequency of the usage. However, various components need to be regularly serviced and replaced and hence, after-sales service forms a critical part of the

manufacturers' offering. Hirers and small contractors are the major end-users of Off-highway vehicles. Large engineering, procurement & construction (EPC) companies account for only about 10% of total demand.

Historic Production development (FY21-26)

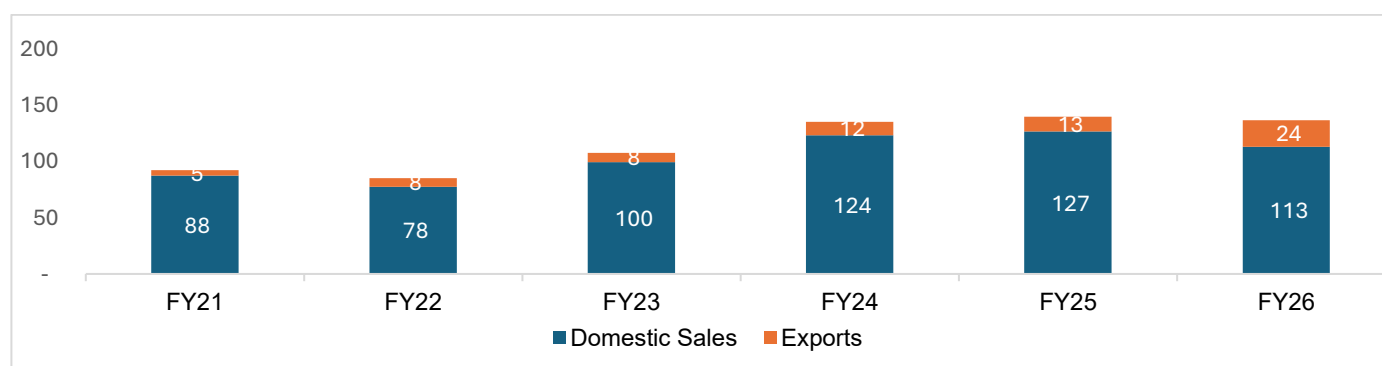


Source: Industry, ICEMA, Crisil Intelligence

The Indian off-highway vehicles industry witnessed a decline of 2% in fiscal 2026, due to project delays as well as slower infrastructure execution as factors impacting domestic demand. However, the industry registered a 80% growth in exports during the year.

Total equipment sales reached had breached the 140,000 mark in fiscal 2025, which declined to 136,995 units in fiscal 2026. The 80% growth in exports played a crucial role in supporting the industry's overall performance.

Split by Domestic Sales and Exports (FY 21-26)

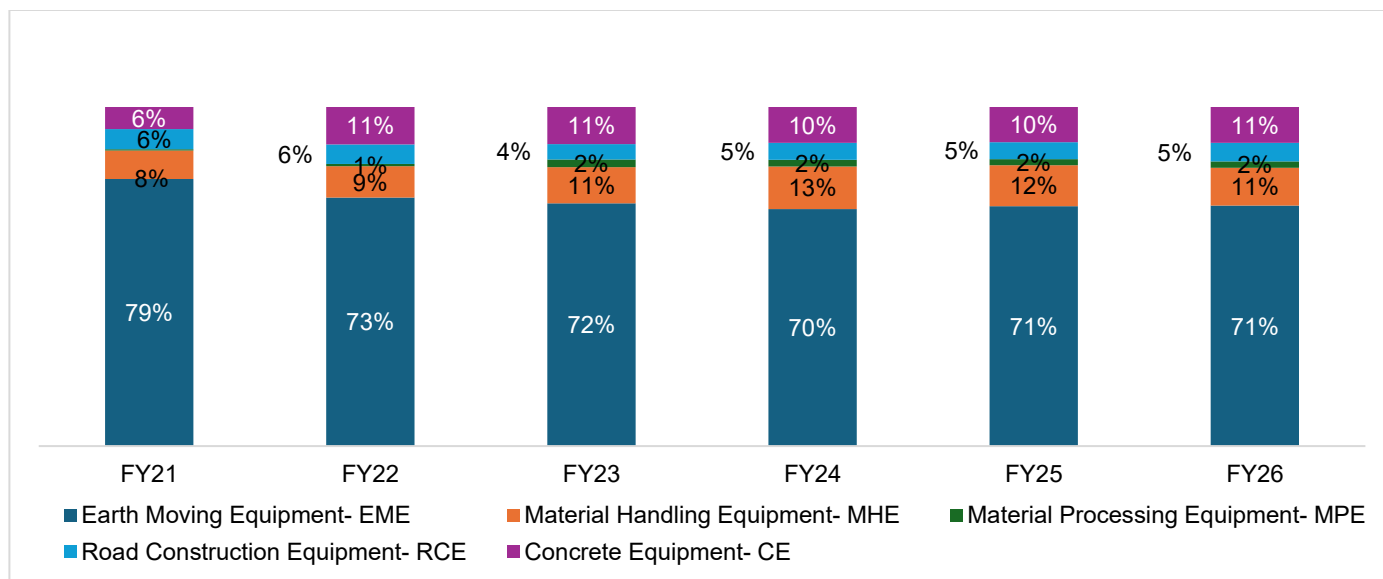


Source: Industry, ICEMA, Crisil Intelligence

Domestic sales declined in fiscal 2026 by 10.8%, from 127 thousand units to 113.2 thousand units due to project delays and slower execution of infrastructure execution in the country. Export volumes rose significantly to 23.7 thousand units from 13.2 thousand units in fiscal 2025, underlining the increasing demand from global markets.

The export surge highlights the growing global acceptance of Indian-manufactured off-highway vehicles market. The domestic demand was temporarily impacted during the election period, which created short-term headwinds, but the strong export performance enabled industry revival in fiscal 2026.

Segment-wise split (FY 21-26) for Production



Source: Industry, ICEMA, Crisil Intelligence

The EME category continued to anchor the off-highway vehicles market, accounting nearly 71% of total industry volumes. The segment recorded sales of 97 thousand units, reflecting a 2% decline over the previous year. Material handling equipment sustained its position as the second-largest segment with 15 thousand units sold. Meanwhile concrete equipment recorded 14.8 thousand units. Road construction equipment contributed 7 thousand units, reflecting continued investment in highways and connectivity projects, and material processing equipment added 2.5 thousand units, serving demand from aggregates and mining applications.

Emission norms and applicability to construction and mining equipment

The construction equipment vehicles (CEVs) are regulated by Bharat stage CEV emission norms, stage IV came into effect from April 2021, and latest CEV stage V implemented from 1st January 2025 aligning with European stage IV and V standard for diesel engines used in non-road mobile machinery. India will become the third region outside of the European Union and United states to adopt Stage V-equivalent emission standards. Non-wheeled equipment, mainly deployed in off-road / off-highway applications like mining and irrigation, continues to be outside the purview of these emission norms for now, in contrast with developed markets (like the EU), where such equipment is treated at par with the on-road CEVs and is regulated together under common norms.

CEV V emission standards will also accommodate a wider range of engines including those smaller than ~37kw and larger than 560kw and stringent emission limits on particulate matter (PM), particulate number (PN) (BS V only), nitrogen oxide (NOX), hydrocarbon (HC), and carbon monoxide (CO). This is the first time India has adopted one set of consistent standards regulating both agricultural and construction equipment.

The stringent PM and PN limits are set at a level which will ensure diesel particulate filters, the key technology needed to effectively control particulate matter emissions from diesel engines, adopted as expected in the European Stage V standards. Engines equipped with selective catalytic reduction also must meet ammonia emission limits of 25 ppm for those less than 56 kW, and 10 ppm for those above 56 kW. Stringent emission regulations are critical to prevent a significant increase in air pollution from non-road diesel equipment. By implementing emission norms for construction equipment and mining, industries can reduce pollution and promote sustainable development.

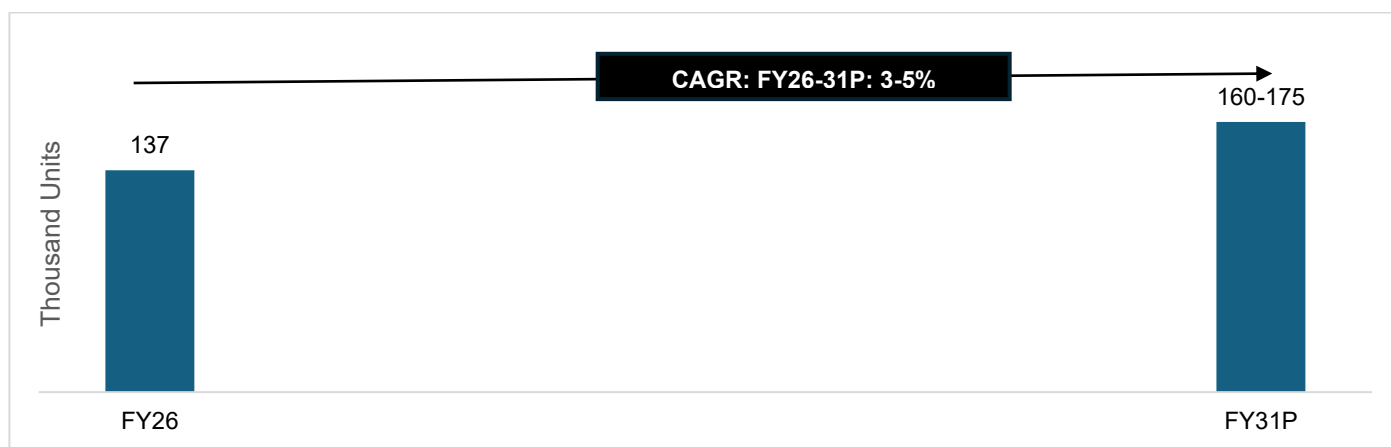
Electrification in Off-highway vehicles

Electrification in India's off-highway vehicle (OHV) segment remains at a very nascent stage, with current penetration limited to a few units (~0.1% of total sales) in fiscal year 2025.

The leading OEMs have already introduced electric construction equipment models signaling the direction the industry is headed. For instance, Caterpillar has been piloting battery-electric excavators and loaders, while Volvo Construction Equipment offers electric compact machines such as the ECR25 Electric excavator and L25 Electric wheel loader.

The adoption is expected to be concentrated on compact equipment such as mini excavators, skid steer loaders, and small wheel loaders, where operating cycles and charging feasibility are more manageable, key advantages include lower operating costs, reduced noise levels, minimal maintenance due to fewer moving parts, and zero tailpipe emissions.

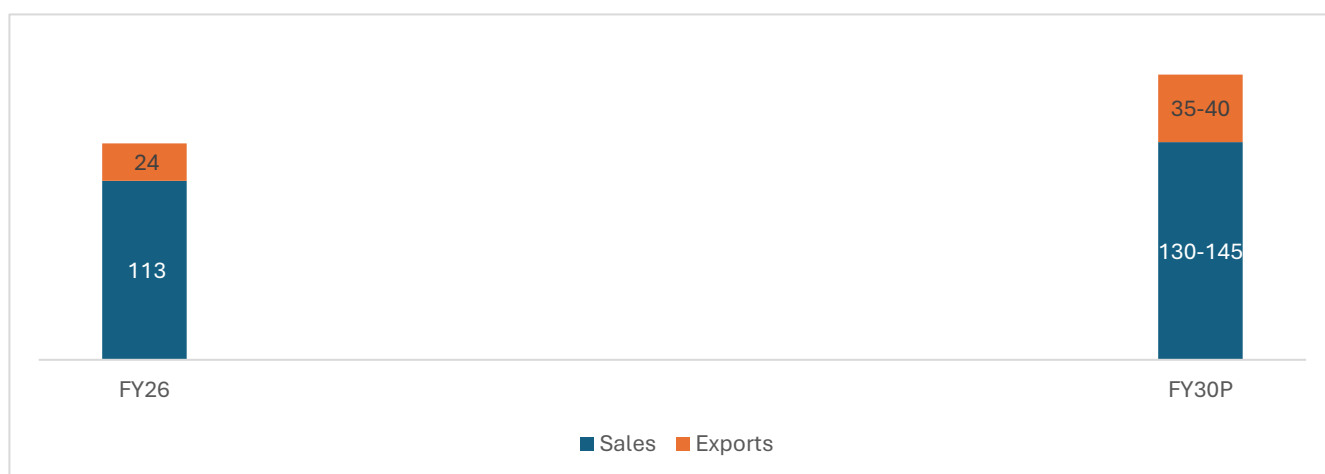
Production Outlook (FY26-31P)



Source: Industry, CRISIL Intelligence

Note: P-Projected

Split by Domestic Sales and Exports (FY26-31P)



Source: Industry, CRISIL Intelligence

Note: P-Projected

The industry is expected to witness steady medium-term growth, with volumes projected to reach 160-175 thousand units by fiscal 2031, implying a CAGR of 3-5% over fiscal 2026 to 2031. After a sharp contraction of 16%

in fiscal 2022 due to pandemic-related disruptions and supply chain constraints, the industry rebounded strongly in fiscal 2023 (22%) and fiscal 2024 (26%), supported by robust infrastructure spending and revival in construction activity.

The industry declined by fiscal 2026. However, structural drivers remain intact. Government-led infrastructure pushes across roads, railways, metros, irrigation, and urban development continues to anchor demand. Increased budgetary allocation toward capital expenditure, focus on logistics efficiency, and large-scale projects under national infrastructure programs provide long-term visibility.

Additionally, rising mechanization in construction, replacement demand, equipment financing availability, and growing rental markets support industry resilience. Mining activity, rural infrastructure development, and housing demand are also expected to contribute to steady equipment utilization levels.

Key Growth Drivers

Roads & Highways Expansion

The continued expansion of India's road network remains one of the largest drivers for construction activity. Government initiatives such as Bharatmala Pariyojana aim to improve freight efficiency through the development of economic corridors, expressways, and border roads. In addition, the Ministry of Road Transport and Highways has significantly increased capital expenditure to enhance national and rural connectivity. These large-scale projects involve extensive earthmoving, grading, and paving activities, thereby driving strong demand for excavators, motor graders, compactors, and road construction equipment.

Growth in Mining & Quarrying Activities

The expansion of coal production and increased extraction minerals to support industrial and power sector in India. Organizations such as Coal India Limited continue to expand open-cast mining operations, while the private sector is also increasing participation in mineral extraction. These operations require heavy-duty earthmoving and material handling equipment, including large excavators, wheel loaders, dump trucks, and drilling equipment, which significantly contributes to construction equipment demand.

Housing and Urban Infrastructure Development

Rapid urbanization and government-led housing initiatives are fuelling large-scale residential and urban infrastructure projects. Programs such as Pradhan Mantri Awas Yojana and Smart Cities Mission aim to improve housing availability, urban mobility, and civic infrastructure across Indian cities. The construction of residential complexes, urban roads, drainage systems, and municipal infrastructure is increasing the utilization of equipment such as backhoe loaders, mini excavators, skid steer loaders, and compact construction machinery.

Airport Infrastructure Expansion

The rapid growth in air passenger traffic and the need to improve regional connectivity have led to increased investments in airport infrastructure. The UDAN scheme is facilitating the development and expansion of airports in Tier-2 and Tier-3 cities. Airport construction involves runway development, leading to increased demand for earthmoving equipment, compactors, graders, and other construction machinery.

Railway Infrastructure Modernization

Significant investments in railway infrastructure are being undertaken by Indian Railways to improve freight capacity, passenger connectivity, and operational efficiency. Key projects include dedicated freight corridors, track doubling, electrification, and station redevelopment. These projects involve large-scale civil construction activities such as embankment development, tunnelling, bridge construction, and track laying, which drive demand for excavators, cranes, loaders, and specialized railway construction equipment.

Electrification penetration in Off-Highway vehicles by fiscal 2030

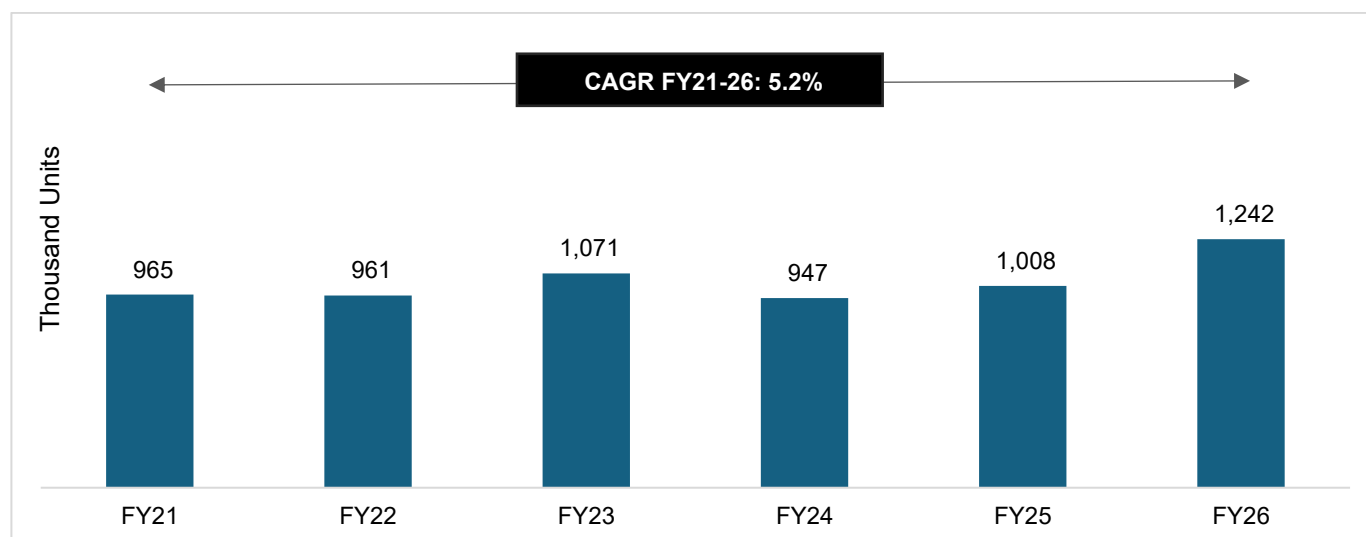
Electrification is still at a nascent stage in the Off-Highway vehicle segment as India advances toward its broader sustainability and decarbonization goals. Industry bodies such as ICEMA have urged the government to include electric and alternative fuel powered Construction Equipment Vehicles (CEVs) under the PM E-Drive scheme to accelerate adoption. The transition, however, remains at an early stage due to challenges such as high upfront equipment costs, limited charging infrastructure at projects sites, and concerns around battery performance in heavy-duty applications.

Sales of electric off-highway vehicles in India are expected to rise from 0.1% currently in fiscal 2026 and is still expected to be less than 1% by fiscal 2031.

Several manufacturers have already introduced electric construction equipment globally and in India. Examples include the Volvo EC230 electric, Caterpillar 301.9 electric, JCB 19C-1E, and CASE CX15ev.

Review and Outlook of Indian Tractor Industry

Historic Production Development (FY21-26)



Source: TMA, CRISIL Intelligence

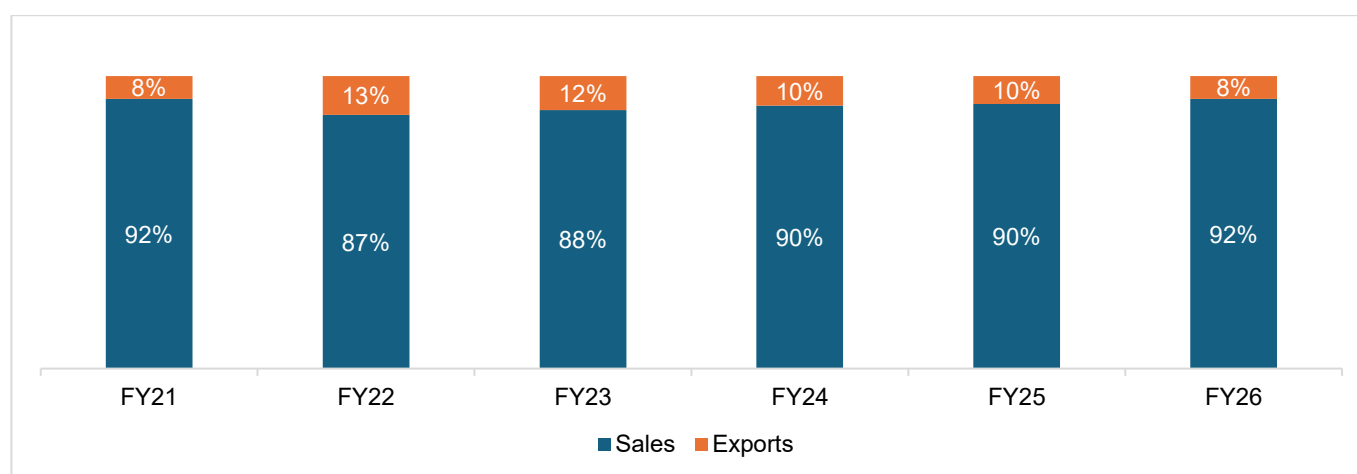
India's tractor industry has demonstrated cyclical resilience over fiscal 2019-2026, with overall production expanding at a CAGR of 5.2% between fiscal 2021 and 2026. The period reflects both structural growth drivers and short-term macroeconomic disruptions.

The tractor industry witnessed growth of 23% in fiscal 2026. The growth was mainly driven by better rural incomes, supported by good monsoon conditions, higher crop production, and improved earnings for farmers. Strong reservoir levels and good kharif and rabi harvests improved farmer confidence and increased demand for farm mechanization. Government support also played an important role in boosting demand. GST reductions from 12% to 5% lowered tractor prices across different horsepower categories, making tractors more affordable and encouraging purchases, especially among first-time buyers and small farmers.

Structurally, India remains one of the world's largest tractor markets, underpinned by a combination of robust domestic drivers and expanding global reach. The prevalence of small and fragmented landholdings continues to fuel steady demand for low-horsepower (HP) tractors, while increasing agricultural mechanization across semi-urban and rural regions further accelerates market growth. Additionally, favorable government schemes aimed at bolstering agricultural infrastructure provide strong institutional support. Beyond domestic consumption, the industry is increasingly capitalizing on growing export opportunities to Asian countries.

Going forward, production growth is expected to remain steady rather than exponential, supported by replacement demand, global, gradual farm consolidation, and technology upgrades. Overall, the Indian tractor industry reflects a demand cycle closely linked to monsoons, rural liquidity, credit access, and government policy support while long-term mechanization trends continue to provide structural stability.

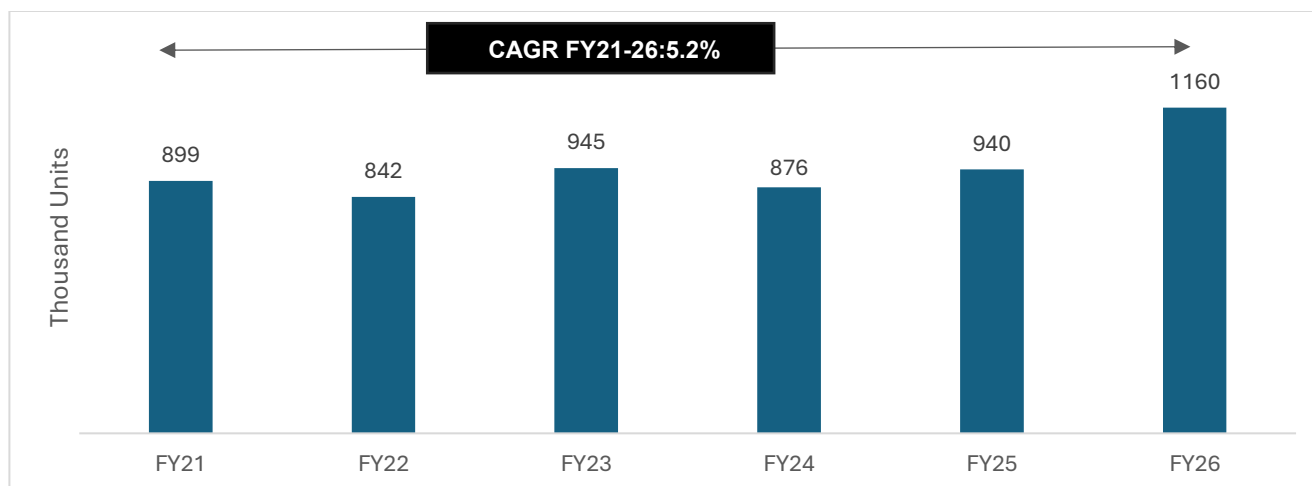
Production split between Tractor Sales and Exports



Source: TMA, CRISIL Intelligence

The production split highlights the industry's strong reliance on the domestic market, which consistently accounted for majority of the total production, ranging between 87% and 92% from FY21 to FY26. While the share of exports saw a notable peak at 13% in FY22, it gradually moderated to 8% by FY26, returning to FY21 levels. This trend underscores that while international markets remain a steady supplementary avenue for manufacturers, domestic demand continues to be the primary driver of tractor production.

Domestic tractor industry sales logged 5.2% CAGR between fiscals 2021 and 2026



Source: TMA, CRISIL Intelligence

In fiscal 2024, domestic tractor sales dropped by 7.4% to ~875,724 units, on account of lower reservoir levels and negative farmer sentiments. Uneven rainfall distribution with monsoon being 6% below normal for the season has led to slower pick-up in the retail market. Erratic monsoon, lower reservoir levels, decline in rabi acreage contributed towards a 7.4% on-year decline in tractor sales for fiscal 2024.

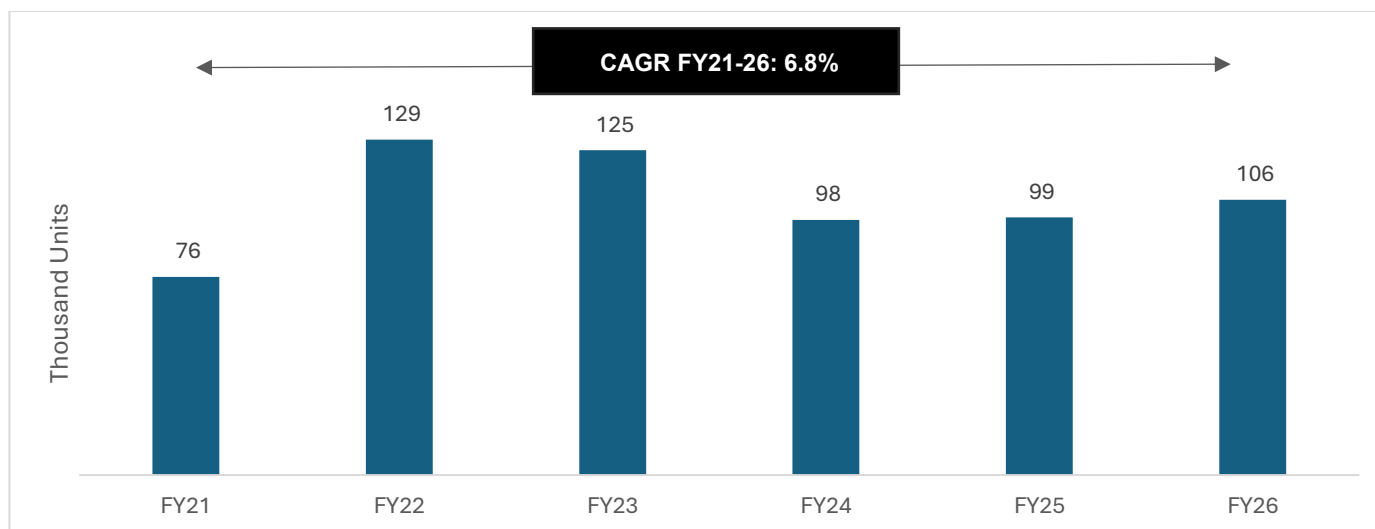
In fiscal 2022, domestic tractor sales declined by 6.4% on-year after growing 26.6% in fiscal 2021. Price hikes by OEMs, higher inventory at dealerships, lower commercial demand, negative farmer sentiment owing to rising cost of cultivation, low fertilizer availability and increase in other expenditure (such as marriages and other social occasions) hampered the demand.

In fiscal 2023, domestic tractor sales grew 12.2% on year to an all-time high of 945,000 units. Healthy crop prices, sound reservoir levels owing to above-normal monsoon, higher MSPs announced by the government and better rabi acreage, all led to positive farmer sentiment. Healthy festival demand because of various schemes and discounts supported the retail growth momentum. Commercial demand during the fiscal, however, remained rangebound in fiscal 2023 owing to slower retail momentum in eastern states and a complete ban on sandmining.

A large part of domestic tractor sales is driven by replacement demand. The typical holding period for a tractor is 6-9 years. Most of the tractors in the country are replaced within 7-8 years. Of the domestic demand, 50-60% constitute replacement demand.

In fiscal 2025, with an above normal monsoon season aiding farmer sentiments, the domestic tractor sales rose by 7-8% in the fiscal 2025 after declining in fiscal 2024. The growth revival, majorly supported by favorable rainfall, boosted kharif crop output, with higher reservoir levels aiding rabi crop profitability which further supported sales. Government measures, including increased crop procurement and higher minimum support prices (MSP) for the rabi season, have boosted farmers' cash flow thereby leading to healthy retail momentum.

Tractor exports



Source: TMA, CRISIL intelligence

Exports, accounted for about 8% of the overall tractor sales as of fiscal 2026. In fiscal 2026, exports demand grew by 7% due to demand from the US, Europe and Asia to support growth but not enough to get back to fiscal 2022 highs. However, the recovery showed positive signs for the industry after two consecutive fiscal years registering less than 100,000 units.

Strategic push, such as setting up a base in foreign countries, by players to cater to global demand would aid export sales. With most of the global companies de-risking exports from China due to the complexities and disruptions in the nation, India has become the natural hedge against Chinese exports. Further, with most of the companies equipped to comply with TREM IV norms, exports have bloomed in the past few years.

The export data for Indian tractors over the years from FY21 to FY26 reflects a fluctuating trend in the international market. This data underscores the influence of various global and domestic factors on the tractor export industry. The CAGR for this five-year period, considering both the ups and downs, stands at approximately 6.8%. While this growth rate may appear moderate, it signifies the resilience of the Indian tractor export industry in the face of various economic and global challenges.

Factors impacting tractor industry

Emission norms

From January 2023, TREM IV was introduced for tractors above 50HP, aligning with Bharat Stage (BS) IV norms for off-road vehicles marked a significant regulatory shift aimed at curbing emissions from the agricultural sector. With application of TREM IV, the price of more than 51 hp tractors has gone up by Rs 1-1.5 lacs further dampening demand with farmers shifting towards 41-50 hp tractors. For this reason, the share of >51 hp tractors had gone down in fiscal 2024.

Implementation of the TREM V emission norms, which are set to take effect from April 1, 2026, could influence buying patterns, potentially leading to pre-buying ahead of the deadline as farmers and dealers look to purchase tractors before price increases. However, the final impact will depend on clarity around regulatory timelines, OEM preparedness, and cost implications for end-users.

EV penetration

Adoption of electric tractors in India remains at a nascent stage, with limited penetration in broader market. Until FY2019, electric tractors in India were few and largely imported from international markets. However, a shift began in FY2020, when domestic manufacturers started investing in the development and production of electric models.

Leading traditional tractor OEMs like Mahindra, Escorts Kubota, and Sonalika (International Tractors Ltd) have since initiated R&D and rolled out their first few prototypes electric tractors. In parallel, dedicated EV startups such as AutoNxt Automation, Bull Work Mobility, and Powerland Agro have focused exclusively on electric tractor development, targeting niche applications.

Despite this growing interest, cumulative registrations of electric tractors in India remain low-just 127 units to date including both imported units and domestically produced prototypes. Deployment has primarily been concentrated in a few agriculturally intensive states like Haryana and Punjab, where state-level support and targeted trials have facilitated early experimentation.

Companies are currently engaging in pilot testing with select customers to evaluate real-world performance, collect user feedback, and optimize design before considering broader commercial rollout. While these steps mark important progress, the current electric tractor volumes are minuscule when compared to the overall Indian tractor market, which sells over 900,000 units annually.

Outlook of Indian tractor industry

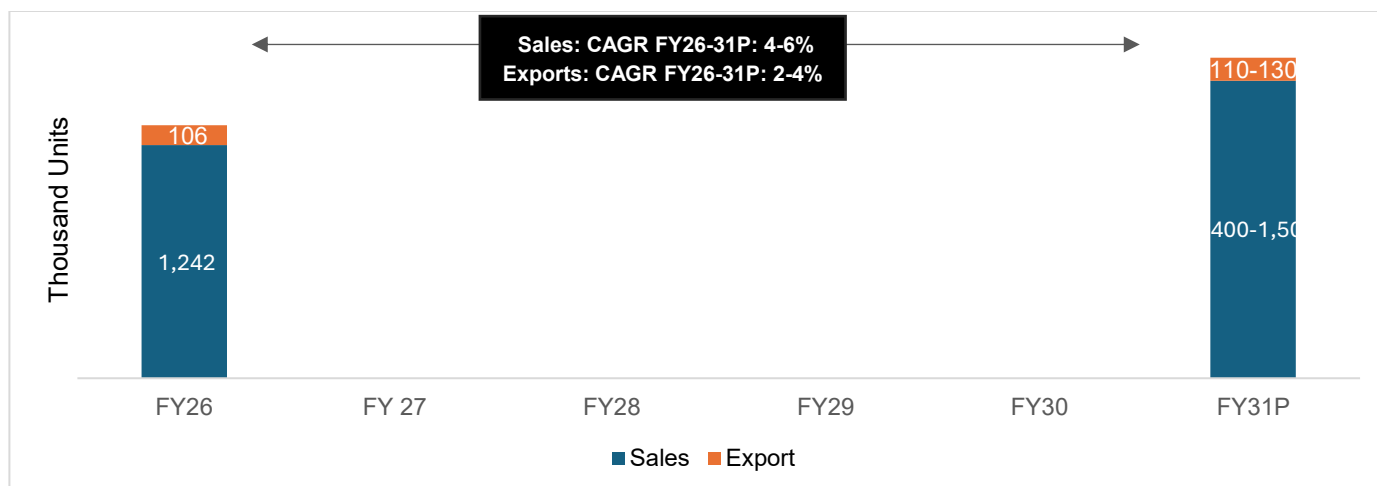
CRISIL Intelligence projects domestic tractor sales to expand at 4-6% compound annual growth rate (CAGR) during fiscals 2026 to 2031, after factoring in one to two years of erratic monsoon during the period along with healthy sales expected in the remaining years. From fiscal 2018 to 2023, the industry registered a CAGR of 5% due to healthy sales in fiscals 2017, 2018, 2021 and 2023.

However, anticipated decline in rabi profitability, low subsidy disbursement in the first quarter of fiscal 2025 amid general elections and slower growth in commercial demand to prevent further growth in fiscal 2025.

In fiscal 2026, domestic tractor sales grew by 23% in volume terms. With El Nino and the lack of clarity with the fertilizer situation in India, the growth in the industry is expected to be relatively slower as compared to the previous fiscal.

Production Outlook for fiscal (FY26-31P)





Note P: Projected

Source: CRISIL Intelligence

Growth up to fiscal 2031 will be on the back of low tractor penetration in the country (three tractors per 100-hectare area), government's focus on improving farm incomes through various schemes, promotion of farm mechanization, and investments to improve rural infrastructure.

Tractor is a cyclical industry, and it has been observed that whenever the industry gets into a downturn, it takes 4-5 quarters for the industry to recover. Thus, assuming that the industry will be impacted by poor monsoon for one to two years between fiscal 2026 and 2031 with the industry taking 4-5 quarters to recover, our long-term assessment suggests that the tractor industry will grow at a CAGR of 4-6%. The growth will be supported by low tractor penetration in India (3 tractors per 100-hectare area); government's focus on improving farm incomes through various schemes, promoting farm mechanization; and investments to improve rural infrastructure. Strong pick up in replacement demand along with higher crop prices aiding revival in the second half of fiscal 2025. Domestic tractor sales grew at a pace of 23% on-year in fiscal 2026 on account of increase in cash in hands of farmers, above normal monsoon, GST reductions and rise expected by 5-7% on-year in fiscal 2027.

Key growth drivers

Rabi crop profitability expected to improve in CY2025. In fiscal 2025, with an above normal monsoon season aiding farmer sentiments. Favorable rainfall boosted Kharif crop output, with higher reservoir levels aiding rabi crop profitability to further support tractor sales. Anticipated price rise of commodities like wheat, maize, paddy and mustard to drive the profitability growth on year in fiscal 2026. Government measures, including increased crop procurement and higher minimum support prices (MSP) for the rabi season, have uplifted farmers' cash flow thereby leading to healthy retail momentum.

Replacement demand expected to be higher

A large part of domestic sales is driven by replacement demand. Typical holding period for a tractor is around 6 to 9 years with most of the tractors being replaced in the country within 7-8 years. Of the overall domestic demand, 50-60% of the sales are replacement demand. For states having high penetration of tractors such as Punjab and Haryana, the replacement demand accounts for about 70-80% of the total sales. While states where farmer incomes are lower as compared to Punjab and Haryana have a lower replacement cycle (higher age tractors) compared to the industry average.

Replacement demand is expected to be higher by 15-17% in fiscal 2026 on account of healthy sales registered in fiscals 2017, 2018 and 2019.

Non-farm usage of tractors on the rise

Commercial demand for tractor accounts for 16-23% of overall tractor demand on aggregate. Apart from their primary application in agriculture operations, tractors are also used to haul bricks, sand, and farm produce. In poor crop years and in months when there is no agricultural activity, renting out tractors for commercial purposes provides farmers an alternate source of income, thereby proving to be a good hedge. Some tractors are designed specifically for haulage operations and are used exclusively in commercial activities. Based on our interactions in industry, tractors are also used as an alternative to pickups for haulage purposes. In fiscal 2026, we estimate commercial demand to rise to 17-19% of total tractor demand which can be attributed to an uptick in PMAY and PMGSY expenditures.

Rental model and low-cost tractors key to penetrating fragmented land holdings in India

Despite the huge potential total arable land offers, the fragmented land-holding pattern in India remains a hurdle. With over 80% of land holdings being small and marginal (less than 2 ha), most farmers are unable to afford tractors. They depend on renting tractors or buying small tractors to improve productivity, a trend which is rapidly gaining hold.

Custom Hiring Centers (CHC) are a major component of the government's 'Sub-Mission on Agricultural Mechanization (SMAM)' policy. These centers maintain farm equipment and machinery which can be rented out, especially to small and marginal farmers who cannot afford them.

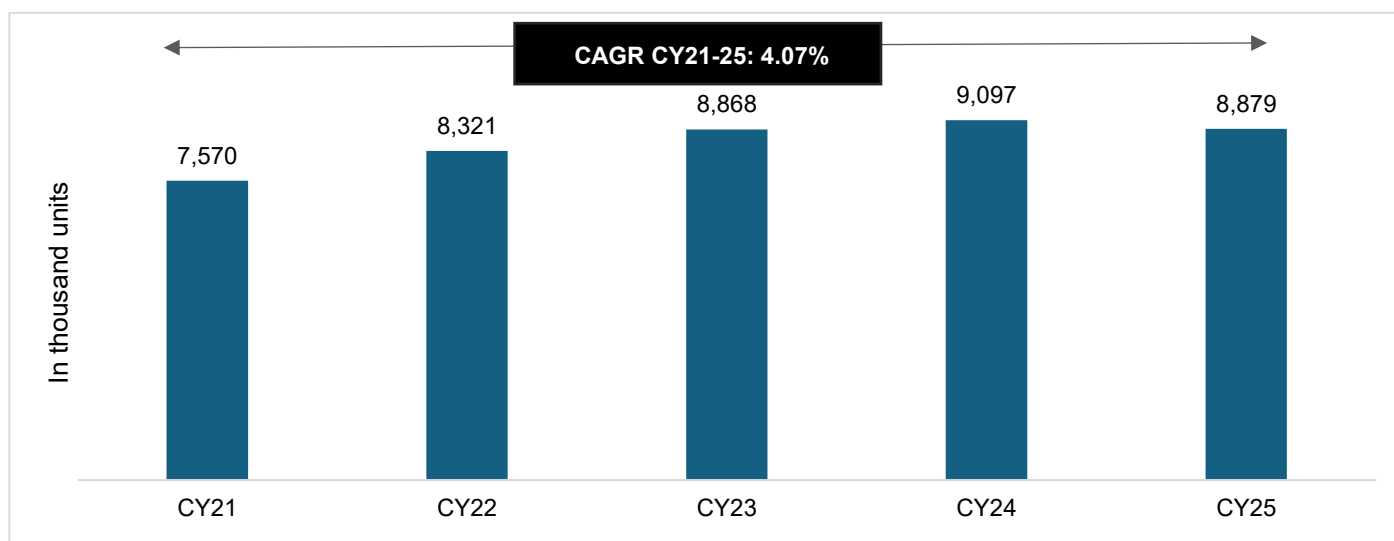
Private sector participation via multiple unique business models is also improving farm mechanization. CHCs face challenges such as lack of awareness among consumers about farm equipment usage, availability issues, high initial investment cost, maintenance of farm machinery, and providing equipment specific to local cropping patterns. Monitoring CHCs remains a major challenge. However, involvement of key stakeholders and introduction of favorable schemes and policies can make the CHC concept successful in India.

Estimated Penetration of Electric Tractors by fiscal 2030

Electric tractor penetration in India is expected to remain very low by 2030, as the segment is still in its early stages. In fiscal 2025, ~25 electric tractors were registered in India, indicating extremely limited adoption. Due to high costs, battery limitations, and lack of rural charging infrastructure, electric tractor penetration is expected to remain below ~1% of the total tractor market by 2030 in most conservative scenarios.

Review and Outlook of US Commercial Vehicles

Historical production development (CY 21-CY25)

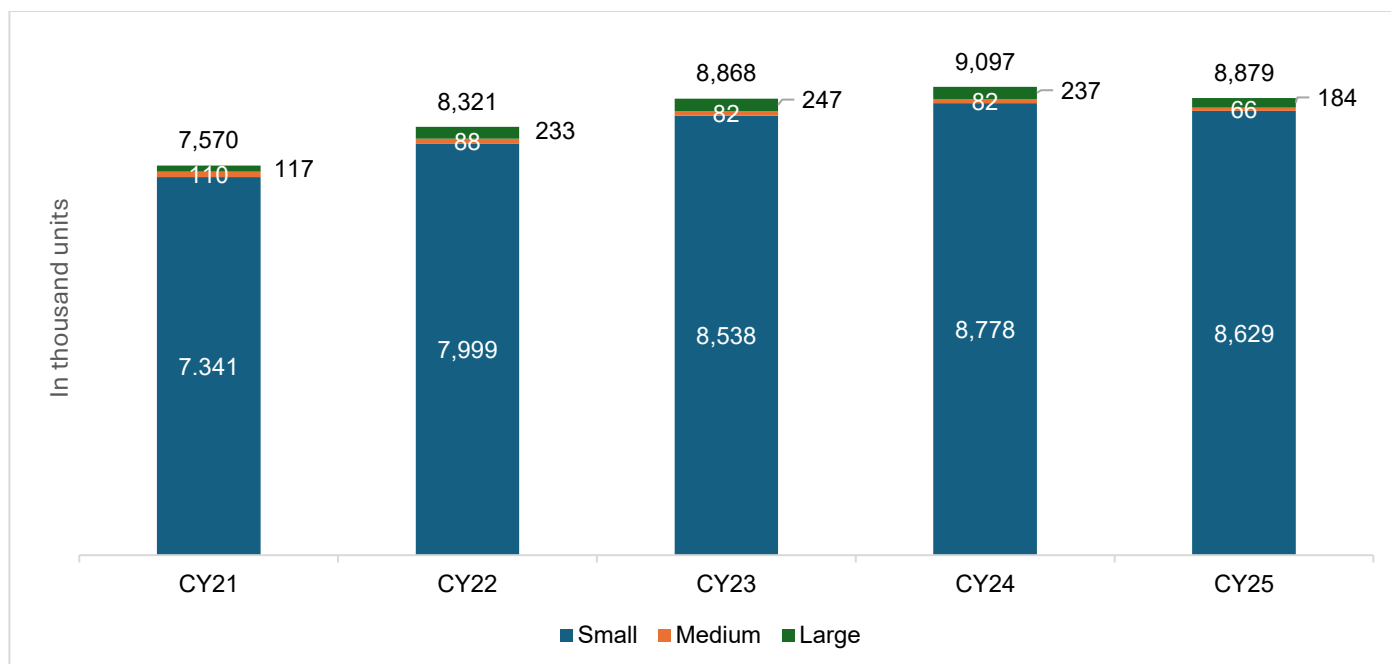


Source: Nexdigm

The US Commercial vehicle market between CY2021 and CY2025 reflects a clear post-pandemic recovery followed by a cyclical normalization. The industry has grown at a CAGR of 4.1% to reach 8.8 Mn units by CY 2025.

The historical production trend of the US commercial vehicle market from CY2021 to CY2025 shows a steady recovery followed by early signs of stabilization. Production increased from 7,570 thousand units in 2021 to 8,321 thousand units in 2022, reflecting a rebound from pandemic-led disruptions despite ongoing semiconductor shortages. This upward momentum continued into 2023 as supply chains improved and demand from freight, logistics, and infrastructure sectors strengthened. The market peaked in 2024 at 9,097 thousand units, driven by strong order backlogs and improved production efficiency. However, in 2025, production slightly declined to 8,879 thousand units, indicating the beginning of a normalization phase, likely due to softening of freight demand and easing replacement cycles. Overall, the period reflects a classic cyclical recovery, sharp post-COVID growth transitioning into a mild correction after reaching peak production levels.

Split by Commercial Vehicles segments (CY21-25)



Source: Nexdigm

Note:

Small – GVW <4 tonnes

Medium – GVW 4<12< tonnes

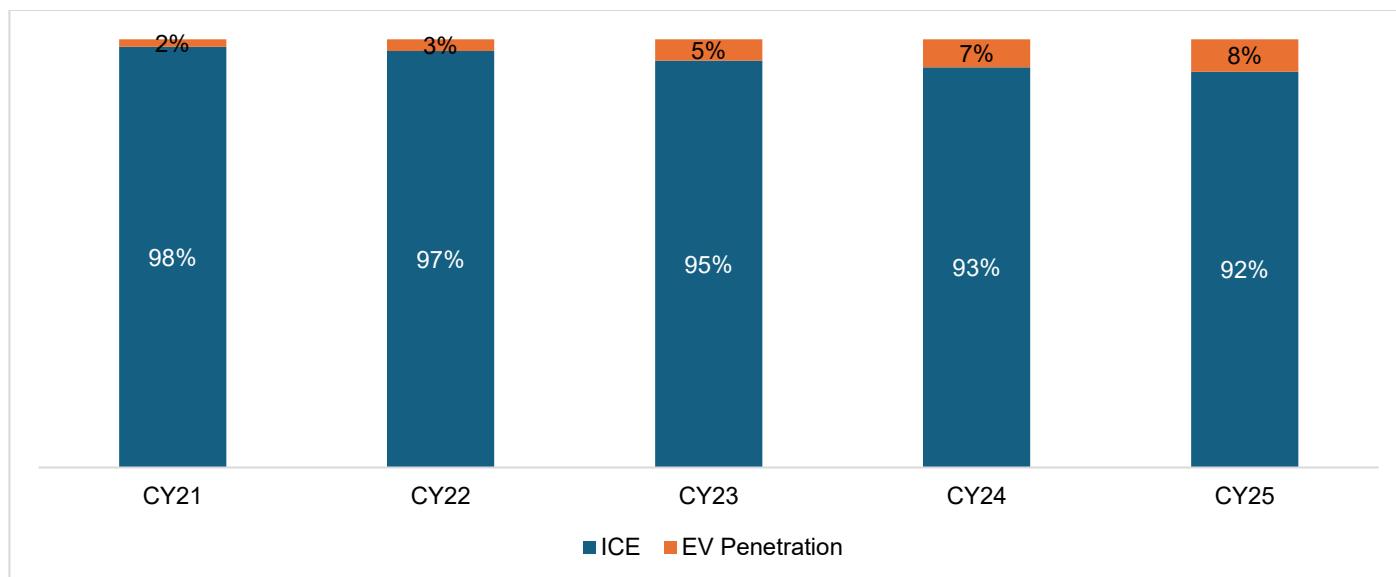
Large – GVW > 12 tonnes

The segment-wise split of US Commercial vehicle production from CY2021 to CY2025, divided into small, medium, and large vehicles, and highlights both structural dominance and cyclical behaviour across segments. Total production rises from 7,570 thousand units in CY2021 to a peak of 9,097 thousand units in CY2024, before slightly declining to 8,879 thousand units in CY2025. Across all years, small commercial vehicles overwhelmingly dominate, contributing the bulk of volumes (over ~95% each year), and steadily increasing from 7,341 thousand units in CY2021 to 8,629 thousand units in CY2025. Their dominance is driven by e-commerce growth, last-mile delivery demand, and the popularity of pickup trucks, which are widely used for both personal and commercial purposes in the US. This segment is less cyclical and benefits from consistent replacement demand and consumer-driven purchases.

Medium commercial vehicles remain the smallest segment, showing marginal growth through CY2024 and a slight decline in CY2025. Medium commercial vehicles segment is supported by urban logistics and regional distribution but remains limited in scale due to competition from both smaller and larger vehicles.

Larger commercial vehicles grew from 117 thousand units in CY2021 to 237 thousand units in CY2024, before dropping to 184 thousand units in CY2025. These follow freight and industrial cycles. The rise from CY2021-2023 is due to strong freight demand, high fleet utilization, and replacement cycles, while the decline in CY2025 reflects falling freight rates and fleet overcapacity, leading to delayed purchases.

EV Penetration in Commercial Vehicles segments (CY 21-25)

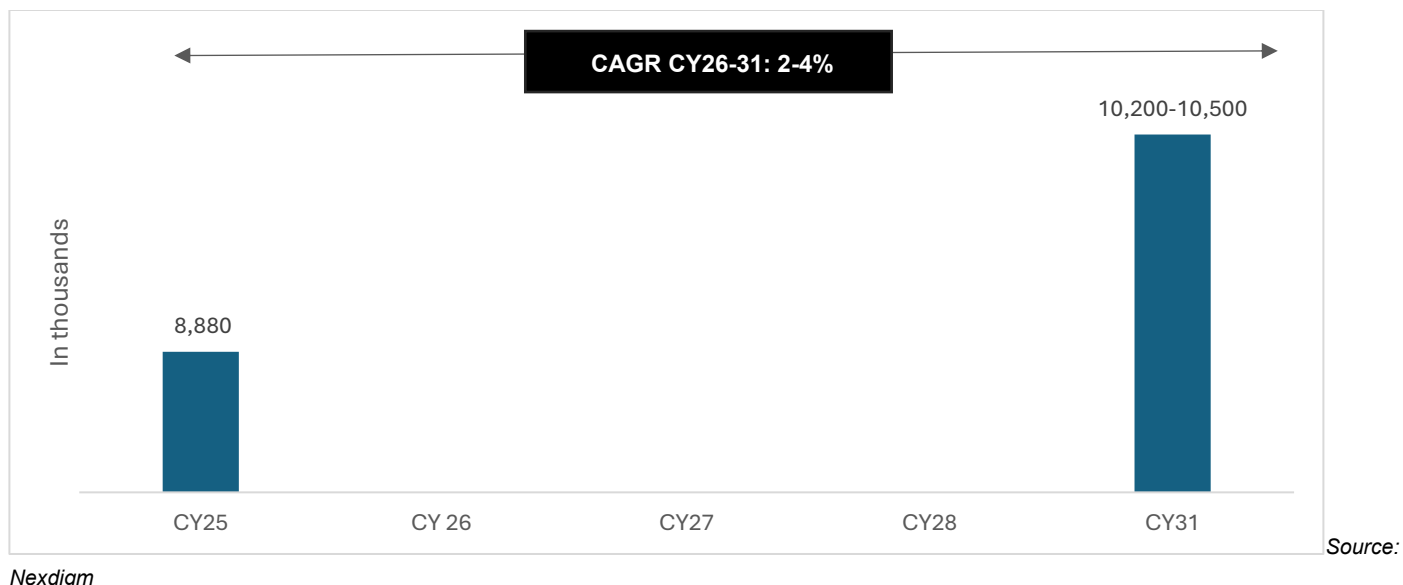


Source: Nexidgm

One major trend in the market is the rise of electric trucks (EVs). Although EVs currently make up a small portion of total production, their growth is outpacing that of traditional internal combustion engine (ICE) vehicles. EV production saw a growth from just over 132,000 units in CY2021 to more than 670,000 units by CY2025, and further to over 1.5 Mn units by CY2030. This rapid increase is driven by regulatory demands, corporate sustainability goals, and advancements in vehicle technology.

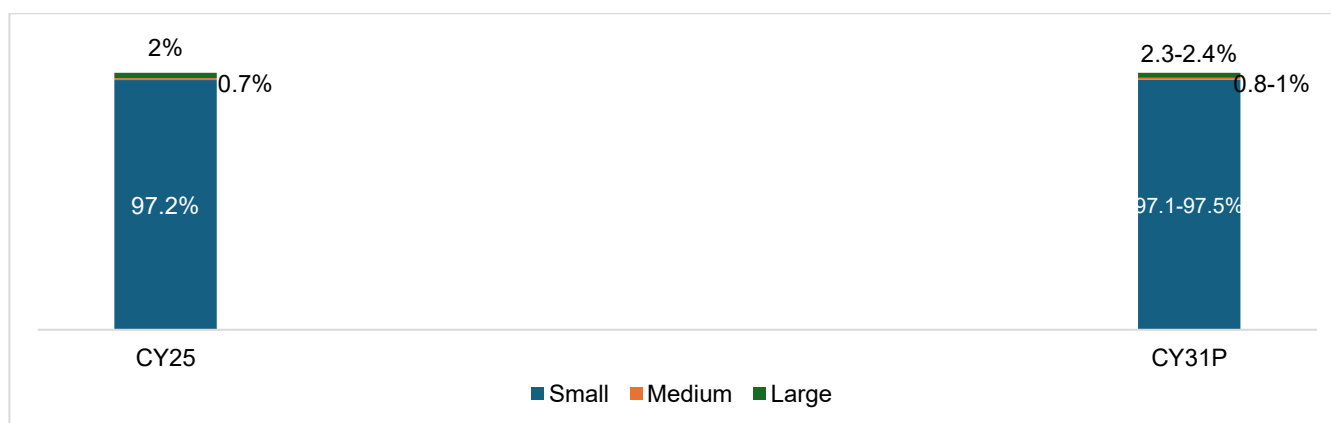
Few examples such as Ford E-transit, Rivian EDV, Brightdrop Zevo 600 are the biggest contributors to the rise from 2% to 8% EV penetration, driven by Amazon, FedEx, UPS adopting last-mile EV fleets. Adoption is growing but constrained by cost and charging infra for fleet depots. Freightliner eCascadia, and Volvo VNR Electric are some of the models used in the heavy commercial vehicle segments.

Production Outlook (CY 25-31P)



The US commercial vehicle production outlook for CY2026 to CY2031 indicates a phase of steady and moderate growth, with volumes expected to increase from 8,800 thousand units in CY2026 to 10,200-10,500 thousand units by CY2031, reflecting a CAGR of 2-4%. This growth trajectory suggests a transition into a mature and normalized market cycle following the volatility of the previous years. The expansion is primarily driven by replacement demand from a large existing fleet, supported by stable activity in logistics, construction, and industrial sectors. While e-commerce and last-mile delivery continue to contribute, their growth is expected to stabilize, leading to more predictable demand for light commercial vehicles. Additionally, the gradual recovery of the heavy truck segment after the 2025 slowdown and the increasing adoption of electric commercial vehicles provides incremental support to volumes. Overall, the outlook reflects a balanced, replacement-led growth environment, with limited cyclicalty and no sharp demand spikes.

Split by Commercial Vehicles segments



Source: Nexdigm

Note:

Small – GVW <4 tonnes

Medium – GVW 4<12< tonnes

Large – GVW > 12 tonnes

Segment-wise split of commercial vehicles (small, medium and large) indicates that small commercial vehicles continue to dominate the market with ~97-98% share throughout the period, while medium vehicles account for ~0.7-1%. Large vehicles accounts for 2-2.4% during the period. The mix remains largely stable over time, with only a slight increase in the share of medium and large vehicles by CY2031.

This trend reflects the structural dominance of small vehicles, driven by sustained demand for last-mile delivery, e-commerce logistics, and pickup trucks. The marginal increase in medium and large segments is supported by gradual recovery in freight demand and infrastructure activity, but their growth remains limited due to higher costs, cyclicity, and operational constraints.

Key Growth Drivers for Domestic Sales

E-commerce and Last-mile Logistics Expansion

The rise of e-commerce is a key factor fuelling growth in the U.S. truck production market. As online shopping continues to gain traction, there has been a significant uptick in parcel volumes and delivery frequency. Additionally reverse logistics has become an increasingly important part of supply chains with consumers returning nearly 30% of online sales, versus about 8% for brick-and-mortar locations. This is transforming logistics networks into more decentralized and high-frequency distribution systems. This change has led to a greater demand for light-duty trucks that are essential for last-mile delivery, especially in urban and suburban settings.

Moreover, the increasing expectations for same-day and next-day delivery have ramped up fleet usage, which in turn speeds up vehicle wear and the need for replacements. Consequently, e-commerce not only boosts the immediate demand for new trucks but also supports long-term production growth by increasing fleet turnover.

Infrastructure Investment and Supportive Policies

Infrastructure investment and supportive policies are crucial for the growth of the U.S. truck production market. The Infrastructure Investment and Jobs Act (IIJA), a massive USD 1.2 trillion federal initiative launched in 2021, has set aside significant funds to upgrade highways, bridges, and essential freight corridors. Better infrastructure means shorter transit times and lower operating costs for fleet operators, which in turn enhances asset utilization and supports increased freight throughput.

At the same time, policy support, like funding for EV charging stations and clean transportation initiatives, is helping to pave the way for a gradual shift toward electric trucks. Together, these efforts enhance the operational efficiency and long-term capacity of the trucking industry, fostering a steady demand for new vehicle production.

Technological Advancements and Fleet Efficiency

The trucking industry is experiencing a major transformation with increasing adoption of telematics, route optimization, and real-time tracking. Industry reports suggest that these innovative technologies can cut fuel consumption and maintenance costs by about 10-15%. With improved efficiency and reliable service, trucking is becoming a more appealing option for logistics providers, which in turn boosts growth and competitiveness in the field.

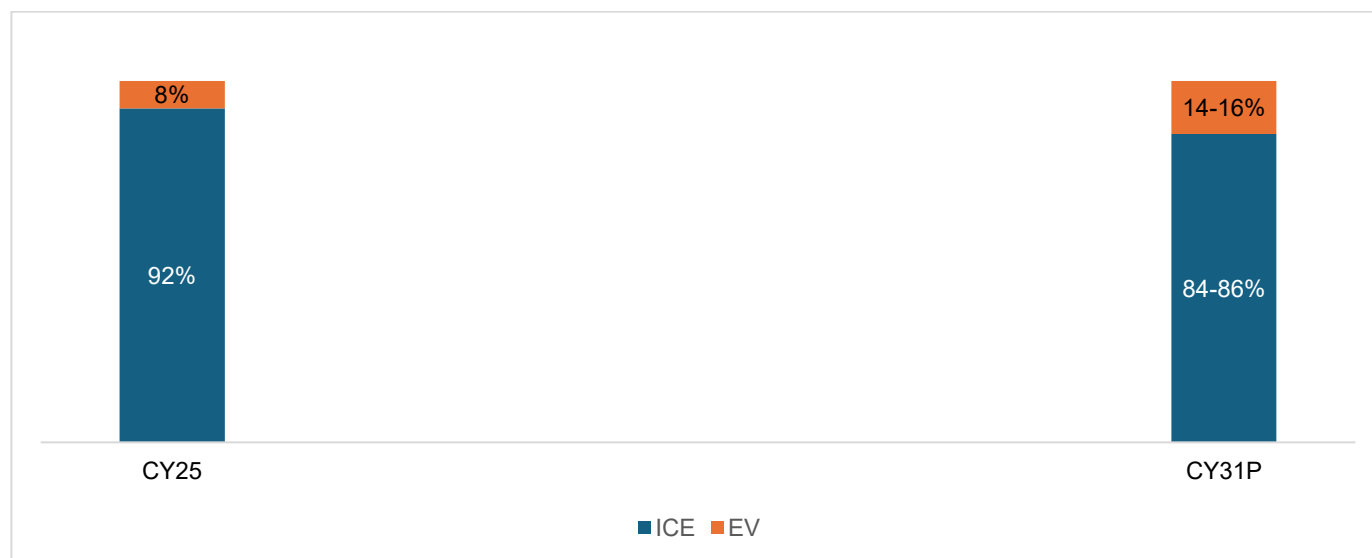
Additionally, as utilization rates climb, vehicles may experience more wear and tears, leading to shorter replacement cycles and a steady demand for new trucks. Moreover, continuous improvements in vehicle design, safety features, and connectivity drive fleet modernization, which also supports production growth.

Exports and Cross-Border Trade

While domestic demand remains primary, trade flows provide a strong structural tailwind supporting overall truck production growth. The deep trade ties the United States has with Canada and Mexico, heavily depends on trucking for moving freight inland. According to the American Transportation Association, trucks were responsible for about 67% of

surface trade with Canada and 85% of goods crossing the Mexican border in 2024, highlighting their key position in cross-border logistics. In 2024, U.S. freight flows with Canada and Mexico equalled USD 1.6 trillion dollars, a 1.8% increase over 2023. As trade volumes grow, driven by manufacturing output, nearshoring trends, and supply chain regionalization, there is a corresponding increase in demand for trucking capacity.

EV Penetration in Commercial Vehicles segments (CY 25-31)



Source: Nexdigm

Note: P-Projected

A meaningful acceleration in EV penetration within the US commercial vehicle market, with EV share expected to increase from ~8% in CY2025 to ~14-16% by CY2031, while ICE vehicles decline from ~91% to 84-86%. This indicates a clear inflection point in electrification, moving beyond early adoption into a more scaled phase. The growth is primarily driven by rapid electrification in light commercial vehicles, particularly in last-mile delivery fleets, where EVs offer lower operating costs and regulatory advantages. Additionally, government incentives, stricter emission norms, and corporate ESG commitments are accelerating fleet transitions. However, the continued dominance of ICE vehicles reflects ongoing challenges in medium and heavy segments, including range limitations, high upfront costs, and charging infrastructure gaps.

Review and Outlook of Wind Energy Industry

Basics of Wind Turbines

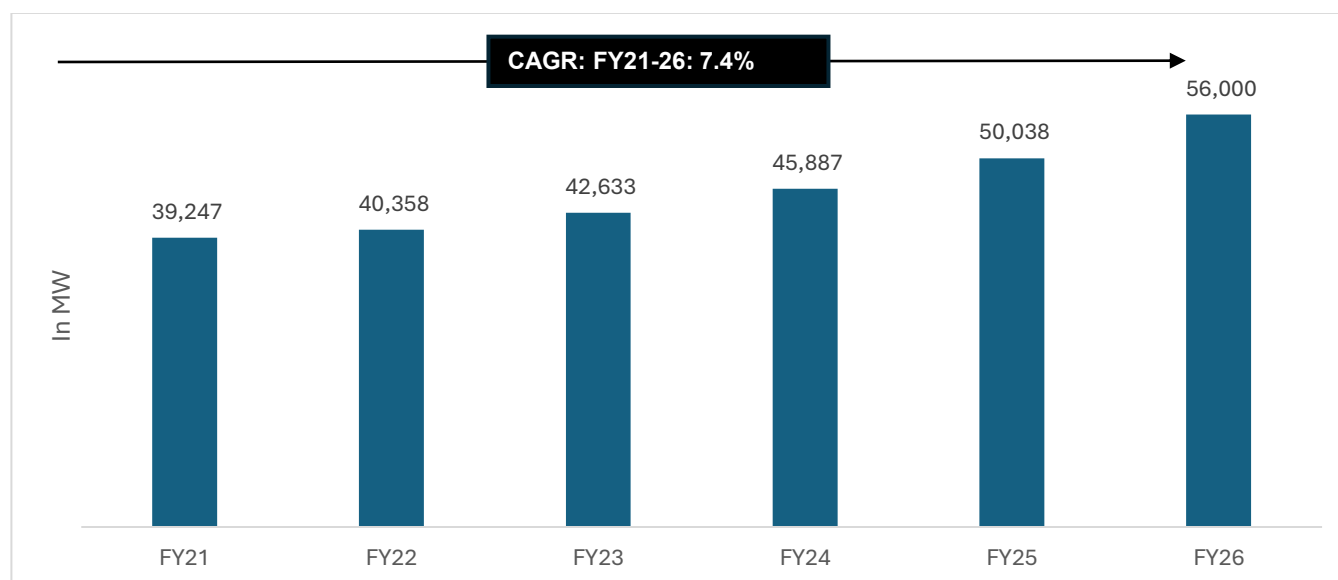
Wind turbines convert the natural movement of air into usable electrical energy. They typically consist of two or three aerodynamic blades attached to a central hub, which is connected to a rotor. When the wind flows over the curved surface of the blades, it creates a difference in air pressure; lower pressure on one side and higher pressure on the other, like how an aircraft wing generates lift. This pressure difference produces a lifting force that causes the blades to rotate.

While wind also pushes directly against the blades, the lift force is stronger and primarily responsible for turning the rotor. As the rotor spins, it drives a shaft connected to a generator. The generator then converts this mechanical motion into electricity.

Wind turbines can operate independently or as part of a larger power network. Stand-alone systems are often used in remote areas for applications such as water pumping or communication systems. In large-scale electricity production,

multiple turbines are installed together in a designated area known as a wind farm. These farms are usually connected to the main utility grid to supply power to homes, businesses, and industries.

Installed Wind Energy Capacity (MW) (FY21-26)



Source: MNRE, CRISIL intelligence

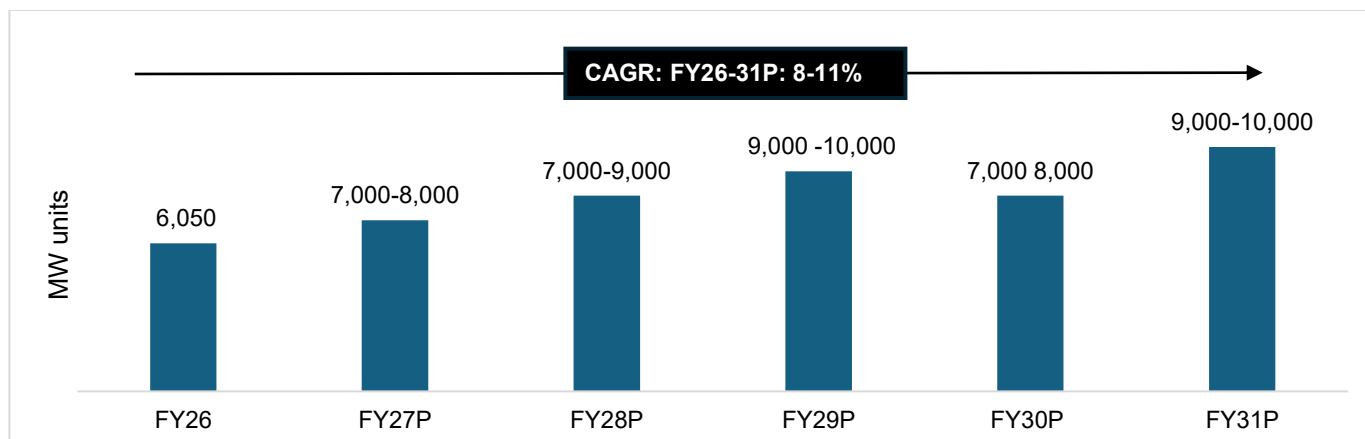
India achieved its highest-ever annual wind capacity addition of 6.05 GW during FY 2025-26 crossing the landmark of 5.5 GW capacity addition in FY 2016-17. This also represents an increase of nearly 46% over the capacity in FY 2024–25 marking a decisive acceleration in India's onshore wind deployment trajectory. With this addition, India's cumulative installed wind power capacity has crossed 56 GW. This milestone reflects renewed momentum in the sector driven by improved policy clarity, transmission readiness, competitive tariff discovery, and a strong project pipeline. This is a result of sustained policy support, improved project execution, and greater pipeline maturity across key wind states. States such as Gujarat, Karnataka, and Maharashtra have been the primary contributors to capacity addition during the year, underpinned by a growing pipeline of wind-solar hybrid projects and the progressive roll-out of green energy open access

India's wind energy sector has witnessed steady and sustained growth over the years, driven largely by a strong domestic manufacturing base and private sector participation. The country has developed a well-established ecosystem that includes project development capabilities, operational expertise, and an annual manufacturing capacity of approximately 18,000 MW. As a result, India ranks among the leading nations globally in terms of installed wind power capacity.

From fiscal 2023 onwards, the sector entered a clear growth phase. Annual additions nearly doubled to about 2,276 MW in fiscal 2023, indicating renewed project activity and improved policy momentum. The upward trend continued in fiscal 2024, with installations rising to roughly 3,253 MW. This acceleration suggests enhanced investor confidence, improved bidding, mechanisms, and stronger pipeline execution.

The momentum appears to have sustained in fiscal 2025, where capacity installations further increased to ~4,151 MW. For fiscal 2026 till the end of January, capacity additions have already reached around 4,613 MW, reflecting robust development and a strengthening renewable energy push.

Estimated Capacity Additions (FY 26-31P)



Source: Ministry of Power, CRISIL intelligence

Note: P: Projected

India's wind energy sector is entering a phase of accelerated growth, driven by a robust project pipeline and the Government of India's ambitious target of achieving 100 GW of installed wind capacity by 2030. Building on the 56 GW installed base and the 6 GW added in FY26, the industry is estimated to add approximately 35 GW to 45 GW of new wind capacity over the next 4 to 5 years (FY27 to FY31). The annual capacity addition run-rate is expected to scale up from current levels to an average of 7 GW to 9 GW annually. The near-term visibility remains highly robust, with 20 GW to 23 GW of wind capacity expected to be commissioned between FY26 and FY28 alone.

Growth Drivers for Wind Energy in India

Technological Advancement in Wind Turbines

Continuous evolution in Wind Turbine Generator (WTG) technology has significantly improved efficiency and output. The availability of state-of-the-art turbine models in India, including larger unit sizes of up to 5.2 MW, has enhanced generation capacity per installations, improving project economics and plant load factors.

Strong Government Policy Support

India's renewable energy targets and long-term decarbonization commitments are major catalysts for wind energy expansion. Clearly defined Renewable Purchase Obligations (RPOs), competitive bidding frameworks, and policy visibility up to 2030 provide demand certainty for developers and investors.

Competitive Tariff-Based Bidding

Transparent reverse auction mechanisms have improved price discovery and reduced tariffs, making wind power cost-competitive with conventional energy sources. This has enhanced investor confidence and increased project pipeline visibility.

Waiver of ISTS Charges

The waiver of Inter-State Transmission System (ISTS) charges for eligible renewable energy projects has significantly improved project viability, particularly for developers selling power across state boundaries.

Module III: Review and Outlook of the Indian Automotive Forging Industry

Brief on Forging methodology

Forging is a foundational manufacturing process that involves the shaping of metal through the application of localized compressive forces. Unlike casting or machining, forging transforms the structural properties of the metal by refining its grain flow. This alignment of the internal grain structure with the external contours of the component results in superior metallurgical strength, enhanced durability, and exceptional fatigue resistance. Consequently, forged components are highly preferred for critical applications across various industrial sectors where reliability and structural integrity are paramount. It uses localized compressive forces, typically by delivering blows with a hammer (often a power hammer) or a die. Forging is often classified into three based on the temperature at which the process is undertaken: cold forging, warm forging, or hot forging.

Forging can be done at various temperatures. The temperature of the metal being forged can be above or below its recrystallisation temperature. If the temperature is above the material's recrystallisation temperature, it is deemed hot forging; if it is below the material's recrystallisation temperature but above 30% of the recrystallization temperature (on an absolute scale), it is warm forging; and if it is below 30% of the recrystallization temperature (usually room temperature), it is cold forging.

Various metals such as alloy steel (alloy steel with titanium, boron, vanadium, etc.), carbon steel and aluminum are used in the forging process. The raw material used in manufacturing can vary depending on the weight and tensile strength required. Forging is followed by the machining process. Automotive components such as connecting rod, crankshaft, rocker arm, steering knuckle, axles, etc. are made through forging.

Core Stages of Manufacturing

The methodology encompasses several critical stages, beginning with the meticulous selection of raw materials such as steel billets, ingots, or blooms. The primary stages of the process are detailed below.

Heating: The raw material is heated in specialized furnaces to optimal temperatures. This thermal process increases the plasticity of the metal, making it highly malleable and ready for deformation without fracturing. Achieving the precise temperature is critical to ensure the metal flows smoothly during the subsequent shaping phase.

Shaping and Deformation: Once the optimal temperature is reached, the heated metal is transferred to forging presses or hammers. Through the application of immense pressure, the metal is forced to conform to specific geometric profiles. This step represents the core of the forging methodology, where the actual physical transformation and grain refinement occurs.

Heat Treatment and Cooling: Following the shaping process, the components undergo controlled cooling and subsequent heat treatment. This phase is critical for relieving internal stress, achieving the desired hardness, and finalizing the mechanical properties of the product. The specific cooling rate is carefully monitored to prevent structural weaknesses.

Finishing and Inspection: The final stages involve removing excess material, surface cleaning, and machining to precise tolerances. Rigorous quality inspection is then conducted to ensure compliance with stringent industry standards. This guarantees that every component meets the exact specifications required by the end user.

Primary Forging Techniques

Depending on the complexity, size, and application of the required component, various techniques are employed to achieve the desired outcome.

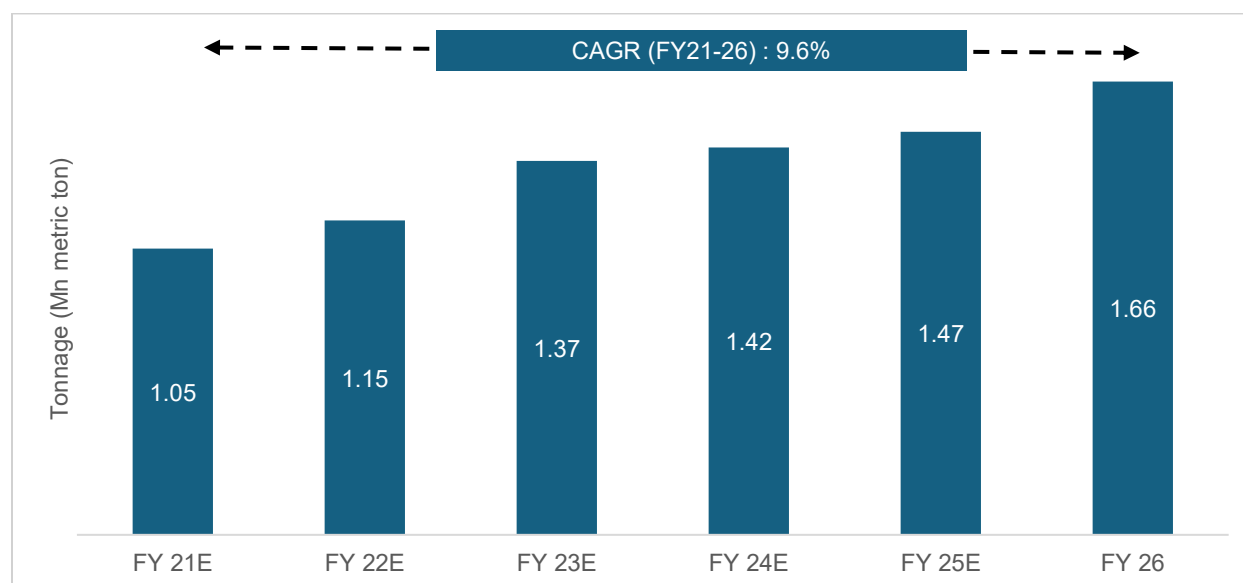
Closed Die Forging: Also known as impression die forging, this method utilizes custom crafted dies that contain the negative profile of the desired part. The heated metal is compressed within these dies, filling the cavities to form complex and highly precise shapes. This technique is optimal for producing high volume, intricately designed components with excellent surface finish.

Open Die Forging: In this approach, the metal is deformed between flat or simply contoured dies that do not completely enclose the material. This technique provides immense flexibility and is primarily utilized for shaping large, heavy-duty components where structural soundness is critical. It allows the operator to manipulate the metal freely to achieve the desired dimensions.

Seamless Rolled Ring Forging: This specialized process begins with a pierced metal preform, which is then rotated and compressed between rollers to increase its diameter and reduce its wall thickness. The result is a seamless circular component characterized by exceptional radial strength, making it ideal for gears, bearings, and heavy machinery applications.

Review of Indian Automotive Forging Industry

Historical Production of Automotive Forging Industry (FY 21- FY26)



E- Estimated

Only includes indirect exports

Source: CRISIL Analysis

The Indian automotive forging industry has demonstrated a robust and consistent growth trajectory over the past five fiscal years. The production volumes expanded from 1.05 million metric tons in fiscal 2021 to reach 1.66 million tons by fiscal 2026 at a strong CAGR of 9.6% during this period. The growth highlights how the sector successfully navigated the pandemic and initial macroeconomic uncertainties. The forging production typically mirrors the automotive vehicle production volumes and notably, the production volume witnessed a significant acceleration between fiscal 2022 and fiscal 2023, rising sharply from 1.15 million metric tons to 1.37 million metric tons, which was also in line with the overall vehicle volumes across segments. After the growth

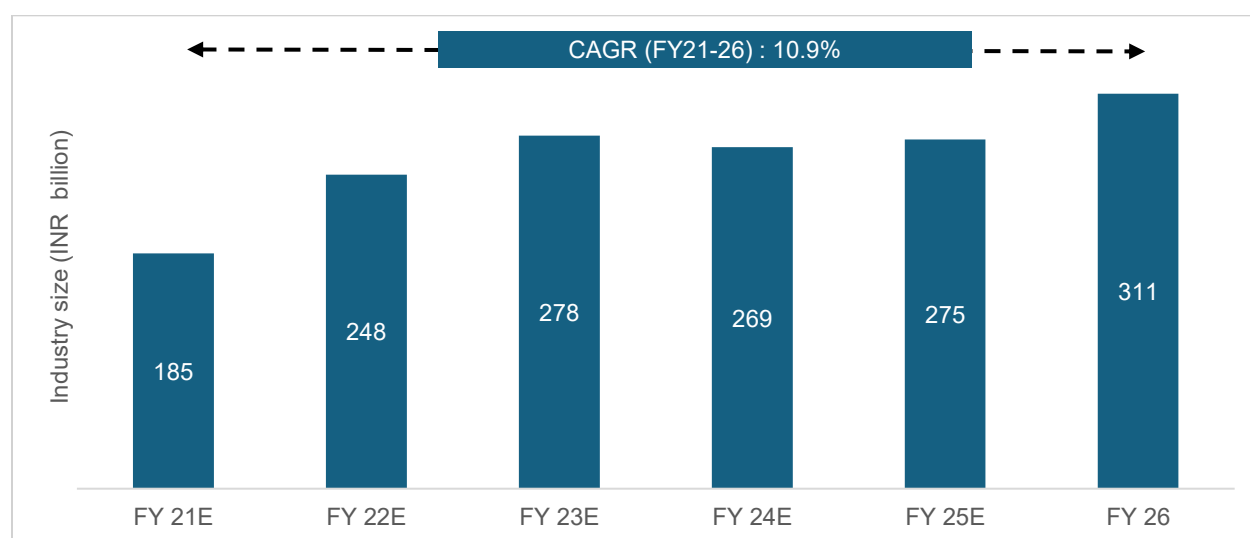
of 19% in fiscal 2023, the industry grew steadily over the next two fiscals, but in fiscal 2026, the industry has grown by 12.5%, driven by the significant growth in production volumes of vehicles across all segments.

There are several key drivers that have underpinned this positive historical trend. The initial phase of this period was characterized by a strong post pandemic recovery, fueled by the release of pent-up consumer demand within the domestic passenger and commercial vehicle sectors. Furthermore, increased government capital expenditure on national infrastructure and construction projects significantly boosted the demand for heavy commercial vehicles, which is a major consuming segment of highly durable forged components.

The industry also benefited substantially from global supply chain realignments. As international original equipment manufacturers increasingly adopted a China plus one sourcing strategy to mitigate supply risks, Indian forging companies experienced a surge in export opportunities. This global shift, coupled with supportive domestic policies aimed at boosting local manufacturing capabilities, provided a substantial impetus to capacity utilization and overall production volumes across the Indian forging landscape.

The overall production capacity of the automotive forging industry is currently 2.8 Mn metric tons, and the capacity utilization is still only 60%, indicating that the industry can cater to an increased demand in the future.

Industry size of Indian Automotive Forging Industry in value (FY 21- FY26)



E- Estimated (Includes both direct and indirect exports)

In terms of value, direct exports of forged components are also considered

Source: CRISIL Analysis

In terms of overall market value over the past five fiscal years. The industry size expanded from INR 185 billion in fiscal 2021 to reach INR 311 billion by fiscal 2026, registering a robust CAGR of 10.9%. The market experienced a period of accelerated value expansion during the initial phase, peaking at INR 278 billion in fiscal 2023. This was followed by a temporary market correction in fiscal 2024, where the size moderated to INR 269 billion. However, the sector demonstrated strong resilience, recovering steadily in fiscal 2025 to INR 275 billion and culminating in a significant upward surge by fiscal 2026.

The fluctuations and overall expansion in market value were influenced by a combination of volume growth and pricing dynamics. The sharp increase in value during the early fiscal years was primarily driven by a surge in raw material costs, particularly steel and energy, which manufacturers passed on to end consumers, thereby

inflating the overall market realization. Additionally, a distinct shift towards vehicle premiumization and the increasing demand for heavier, more complex forged components in both the automotive and industrial sectors contributed to a higher average realization per ton.

The subsequent moderation in fiscal 2024 can be attributed to the stabilization of global commodity prices and inventory rationalization by major original equipment manufacturers. As raw material prices normalized, the value growth temporarily decoupled from the underlying volume growth. The strong recovery in the latter half of the period reflects sustained domestic demand, increased infrastructure allocations, and the successful execution of export strategies, which collectively drove the industry to its highest valuation in fiscal 2026.

Pandemic and its aftermath

The onset of the global health crisis brought unprecedented disruptions to the Indian automotive forging sector. Nationwide lockdowns and stringent containment measures led to the temporary cessation of manufacturing activities across original equipment manufacturers and their tiered supply chains. The industry faced acute challenges including severe labor shortages, restricted movement of raw materials, and significant liquidity constraints. Consequently, the immediate phase was characterized by a sharp contraction in order volumes and deferred capital expenditure, as the broader automotive market grappled with profound macroeconomic uncertainty.

As containment measures eased, the industry witnessed a swift and vigorous recovery. This resurgence was initially catalyzed by the release of pent-up consumer demand, particularly in the personal mobility and commercial vehicle segments. Forging companies quickly adapted to the new normal by implementing stringent health protocols and accelerating digital integration within their shop floors to ensure uninterrupted production. Furthermore, a renewed consumer preference for personal transportation over shared mobility provided a critical short-term boost to automotive sales, which directly translated into rapidly expanding order books for forged components.

The aftermath of the pandemic induced a fundamental restructuring of global sourcing strategies. Recognizing the vulnerabilities of highly concentrated supply networks, global OEMs accelerated the adoption of a China plus one strategy to mitigate future risks. This geopolitical and economic shift presented a massive structural opportunity for Indian forging manufacturers, who emerged as reliable, high quality, and scalable alternatives in the global market. Coupled with domestic policy initiatives aimed at fostering self-reliance in manufacturing, the pandemic ultimately acted as a catalyst for enhanced operational resilience. This transformation laid the groundwork for the robust and sustained growth trajectory that the industry has experienced in the subsequent fiscal years.

Growth Drivers

Robust Domestic Automotive Demand and Premiumization

The Indian automotive sector has witnessed sustained expansion driven by rising disposable incomes, rapid urbanization, and favorable demographic tailwinds. Concurrently, there is a distinct consumer shift towards premium utility vehicles and heavier passenger cars. These advanced vehicles require highly durable and complex forged components to support increased vehicle weight, higher engine torque, and enhanced performance standards. This trend of vehicle premiumization directly drives both volume growth and higher value realization for forging manufacturers.

Global Supply Chain Realignment and Export Opportunities

Global OEMs are increasingly diversifying their sourcing networks to build resilient and risk averse supply chains. The widespread global adoption of a China plus one strategy has positioned India as a highly preferred

manufacturing hub. Indian forging companies, equipped with proven metallurgical capabilities, scalable infrastructure, and significant cost competitiveness, are successfully capturing a much larger share of the global auto component export market.

European Energy Crisis and Production Shifts

The recent energy crisis across the European Union has significantly escalated operational costs for energy intensive manufacturing processes such as metal forging. As utility expenses impact the commercial viability of European facilities, OEMs and tier one suppliers are increasingly outsourcing component production to regions with more stable and economical energy environments. India, equipped with a mature forging ecosystem and reliable power infrastructure, has emerged as a primary beneficiary of this structural shift, capturing substantial outsourced manufacturing volumes from European clients.

Inherent Cost Advantages of the Domestic Ecosystem

The Indian forging sector benefits from deeply ingrained cost advantages that significantly enhance its global competitiveness. A combination of highly skilled yet cost effective labor, robust localized availability of essential raw materials such as specialized steel, and favorable overhead structures allows domestic manufacturers to maintain highly competitive pricing models. This inherent cost efficiency, achieved without compromising on stringent international quality standards, positions Indian forging companies as highly attractive strategic partners for global automotive brands seeking to optimize their procurement budgets.

Western Transition to Electric Vehicles

As automotive markets in the United States and the European Union accelerate their transition towards electric vehicles, domestic suppliers in those regions are rapidly reallocating capital and manufacturing capacity away from traditional internal combustion engine components. This accelerated transition creates a significant supply chain vacuum for legacy automotive parts, which Indian forging companies are exceptionally well positioned to fill. Furthermore, Indian manufacturers are simultaneously adapting their capabilities to supply electric vehicle agnostic forged components, such as advanced steering, chassis, and suspension parts, thereby capitalizing on both the legacy market consolidation and the emerging electric mobility wave.

Infrastructure Development and the Commercial Vehicle Cycle

The sustained focus of the government on capital expenditure, particularly in road construction, mining, and urban infrastructure development, has spurred significant demand for heavy commercial vehicles and earth moving equipment. The operational stress and structural integrity required for these heavy-duty applications relies heavily on high quality forged parts such as axles, crankshafts, and chassis components. This continuous infrastructure push ensures a steady and voluminous order pipeline for the forging industry.

Favorable Policy Interventions and Domestic Manufacturing Push

Government initiatives aimed at promoting manufacturing self-reliance have provided a substantial impetus to the domestic auto component ecosystem. Interventions such as the Production Linked Incentive scheme (PLI scheme) encourage capital investment, capacity expansion, and technological upgrades. These supportive policies not only reduce import dependence but also strengthen the overall global competitiveness of the Indian forging sector by incentivizing scale and quality enhancements.

Technological Advancements and Lightweighting Trends

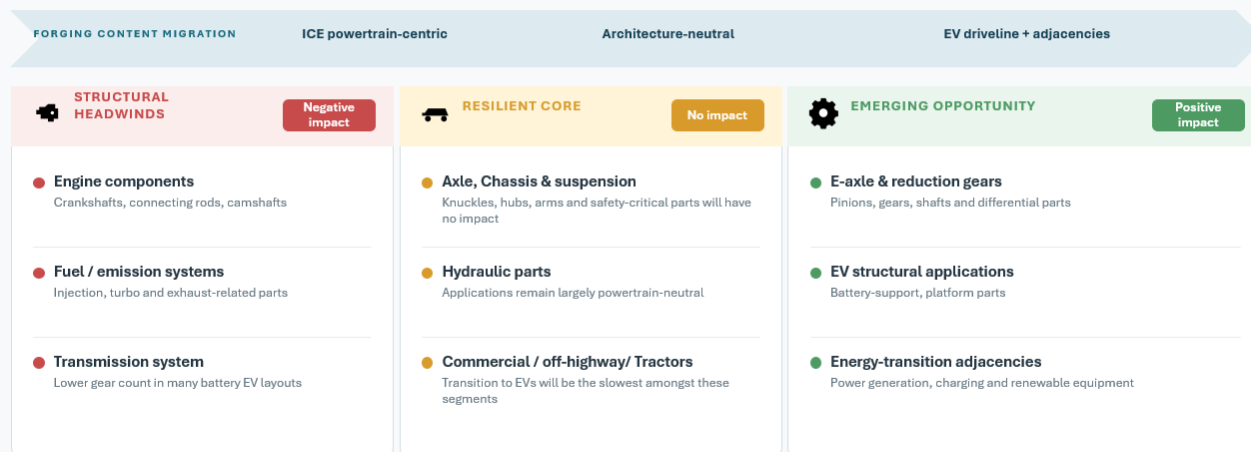
As the automotive industry evolves to meet stringent global emission norms and improved fuel efficiency standards, there is a growing engineering emphasis on vehicle lightweighting. Forging manufacturers are increasingly adopting advanced materials, such as micro alloyed steels and aluminum, alongside precision forging techniques. These advancements enable forging manufacturers to produce components that offer

superior strength to weight ratios. This technological evolution opens new avenues for specialized, high margin forged products, ensuring the industry remains aligned with modern automotive engineering requirements.

Impact of electrification on the automotive forging industry

Electrification reshapes forging demand

The product mix shifts away from ICE engine parts toward high-precision driveline, chassis and adjacent energy-transition applications



Electrification is expected to result in a gradual realignment of demand within the forging industry, with the nature and extent of the impact varying across products and vehicle segments. Battery electric vehicles typically have fewer engines and powertrain components compared with internal combustion engine vehicles. Accordingly, increased adoption of electric vehicles may reduce demand for certain traditional forged components used in engines, fuel injection systems, emission systems and conventional transmissions, including crankshafts, connecting rods and camshafts.

However, a significant portion of forging demand is associated with components that are not directly dependent on the type of powertrain. Forged components used in chassis, suspension, steering, wheel end and safety systems are expected to remain relevant across internal combustion engines, hybrid and electric vehicle platforms. In addition, the higher weight of battery packs and the resulting load and durability requirements may support continued demand for high strength and safety critical forged components in electric vehicles.

Electrification is also creating opportunities for forging manufacturers in emerging product categories. Electric vehicle driveline systems require components such as rotor shafts, reduction gears, pinions, differential components, transmission gears and other precision engineered parts. Further opportunities may arise from components used in battery structures, vehicle platforms, charging equipment, power generation systems and renewable energy applications. The transition is therefore expected to change the composition of forging demand rather than result in a uniform decline across the industry.

Forging manufacturers with diversified end market exposure, product development capabilities and integrated forging, heat treatment, machining and finishing operations may be better positioned to respond to this transition. The ability to manufacture complex and precision engineered products, develop components in collaboration with customers and expand into electric mobility and energy transition applications can support diversification from traditional internal combustion engine products. Accordingly, the impact of electrification on individual forging manufacturers will depend on their existing product portfolio, exposure to engine related components, customer relationships and ability to develop products for emerging applications.

Exports and Imports of Forging Industry in India

Exports

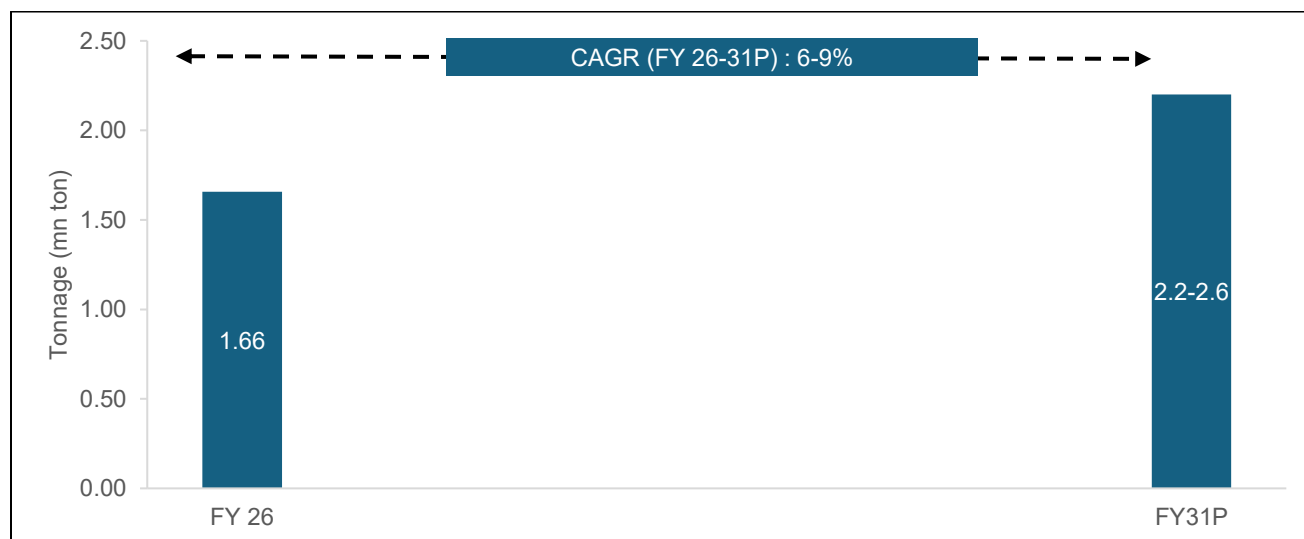
The Indian forging industry has established a formidable presence in the global market, emerging as a prominent net exporter of high quality automotive and industrial components. Over the past few years, export volumes have witnessed a robust upward trajectory. This growth is primarily propelled by the strategic realignment of global supply chains, as international original equipment manufacturers actively pursue a China plus one sourcing strategy. Indian manufacturers have capitalized on this shift by offering a compelling combination of cost competitiveness, advanced metallurgical capabilities, and strict adherence to global quality standards. Key export destinations include North America and Europe, where Indian forged parts are increasingly integrated into passenger vehicles, commercial vehicles, and heavy machinery. As of fiscal 2026, the exports stood at around 30% of the overall production volumes of forged components. Before the pandemic, the exports share was 15-20%.

Imports

Conversely, the import of forged components into India remains relatively limited and is largely confined to highly specialized or exceptionally heavy forgings that require niche manufacturing capabilities. Historically, these imports were necessary to meet the stringent requirements of specific aerospace, defense, or advanced industrial applications where domestic capabilities were still developing. However, there is a distinct and accelerating trend towards import substitutions across the sector. Driven by supportive government policies and significant capital investments in advanced manufacturing technologies, domestic forging companies are rapidly upgrading their infrastructure. This progressive localization is steadily reducing the reliance on imported components, further strengthening the domestic manufacturing ecosystem and improving the overall trade balance for the sector.

Outlook of Indian Automotive Forging Industry

Outlook of Automotive Forging Industry Production (FY 26-31)



P-Projected (Includes only indirect exports)

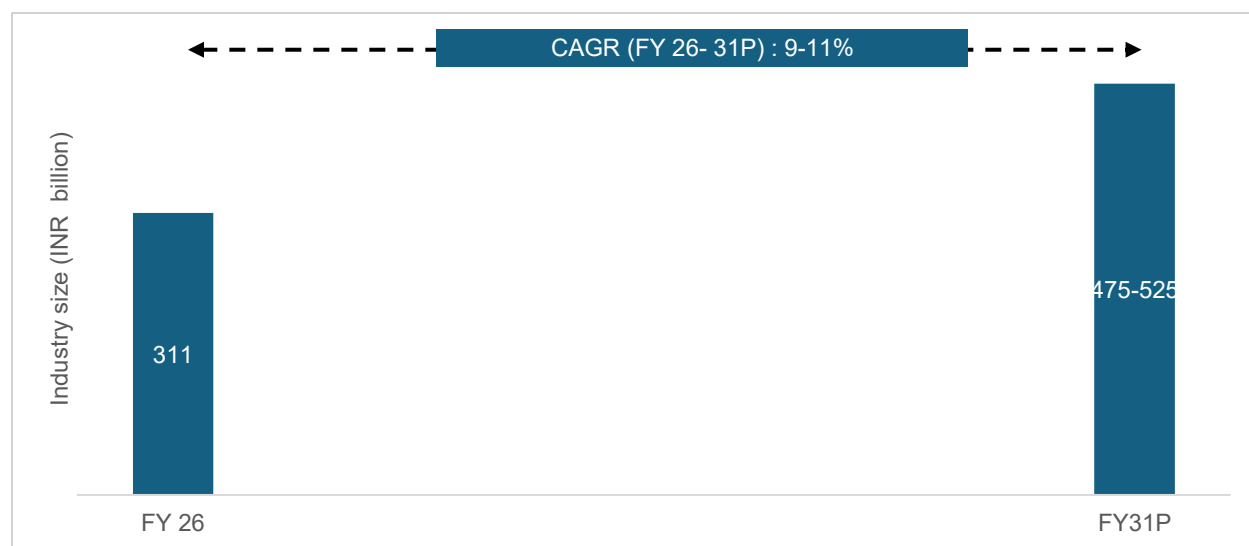
Source: CRISIL Analysis

The production volume of the Indian automotive forging industry is projected to increase from approximately 1.66 million tonnes in FY2026 to between 2.2 million tonnes and 2.6 million tonnes by FY2031, representing a CAGR of 6.9% during the period. This growth is expected to be primarily supported by the expansion of domestic vehicle production across passenger vehicles, commercial vehicles, tractors and two-wheelers, which is likely to increase demand for forged components used in powertrain, transmission, steering, suspension and chassis applications.

Growth in the industry is also expected to be supported by the increasing use of high-strength and lightweight forged components by automotive original equipment manufacturers. The implementation of more stringent fuel-efficiency, emission and vehicle-safety requirements is encouraging manufacturers to improve component strength, durability and weight efficiency. Forged components are generally preferred in safety-critical and load-bearing applications due to their mechanical strength, fatigue resistance and reliability. Accordingly, the increasing adoption of higher-performance components in vehicles is expected to support the value addition and technological advancement of the automotive forging industry.

India's growing position as an automotive and auto-component manufacturing base is also expected to contribute to industry growth. International automotive manufacturers are increasingly evaluating India as a sourcing and manufacturing destination, supported by the availability of an established supplier ecosystem, skilled workforce and relatively competitive manufacturing costs.

Industry size of Indian Automotive Forging Industry in value (FY 26- FY31)



P-Projected (Includes both direct and indirect exports)

Source: CRISIL Analysis

On the global stage, the industry is exceptionally well positioned to capitalize on structural supply chain realignments. As the European energy crisis impacts the commercial viability of Western manufacturing and as those same markets accelerate their transition toward electric mobility, global OEMs will increasingly rely on the inherent cost advantages and proven metallurgical expertise of the Indian forging ecosystem. By effectively capturing the resulting supply chain vacuum for legacy internal combustion engine parts and

expanding direct component export volumes through China plus one sourcing strategies, the Indian automotive forging industry is set to firmly solidify its status as a critical, indispensable hub in the global manufacturing landscape.

Module IV: Review and Outlook of Transmission Gears and Shafts Industry

Role of transmission and its importance

Component	Brief description / function
Input shafts	Rotating shafts that receive power from the engine through the clutch and transmit it to the internal gear arrangement of the transmission system.
Layshafts	Shafts positioned parallel to the main shaft carry a set of gears and transmit power from the input shaft to the main shaft at the selected gear ratio.
Main shafts	Principal transmission shafts that carry the selectable gears and transmit the resulting torque from the gearbox to the output side of the drivetrain
Countershafts	Intermediate shafts carrying multiple gears that mesh with gears on the main shaft to facilitate changes in speed and torque. The terms countershaft and layshaft may be used interchangeably in certain transmission configurations.
Hollow shafts	Tubular transmission shafts are designed to transmit torque while reducing component weight and rotational inertia, and, in certain configurations, allowing another shaft or component to pass through the central opening.
Intermediate shafts	Shafts are located between the input and output stages of a transmission that support the transfer of power across different gears or transmission sections.
Power take-off shafts	Shafts that transfer power from the engine or transmission to auxiliary equipment, including hydraulic pumps, implements and other attachments used in tractors and off highway vehicles.
Drive shafts	Rotating shafts that transmit torque from the transmission to the differential, axle or other driven components of the vehicle.
Speed gears	Toothed transmission components that operate in different gear ratios to vary the speed and torque delivered through the transmission system.
Spindles	Precision cylindrical components that support the mounting and rotation of gears, bearings or other rotating elements within the transmission or drivetrain assembly.
Output flanges	Flanged components fit at the output end of the transmission to connect the output shaft with the drive shaft or other downstream drivetrain components.
Clutch bell housings	Structural housing is located between the engine and transmission that enclose the clutch assembly and facilitate the mounting and alignment of the transmission with the engine.

The automotive industry's pivot to electric vehicles (EVs) initiates a fundamental and irreversible transformation for these components. The core principle of an electric motor is its ability to produce instant, maximum torque from 0 RPM and operate efficiently across an exceptionally wide speed range, which renders the traditional multi-speed gearbox obsolete. As a result, the current reality for EVs is a radical powertrain simplification, where the complex gear set is replaced by a single-speed reduction gearbox, often comprising just a pinion and a larger bull gear to step down the motor's high RPM to a usable wheel speed. Looking forward, this trend will profoundly reshape the industry. While the overall volume and mass of gears and shafts per vehicle will decrease dramatically, the technical requirements for the remaining components will intensify. Future EV gears must be manufactured to extremely high precision to mitigate noise, vibration, and harshness (NVH) in the silent EV cabin. Furthermore, they must be engineered with advanced materials and designs to reliably handle the instantaneous and powerful torque delivery of electric motors. This marks a significant market evolution away from high-volume manufacturing of standard components towards a more specialized, technologically advanced focus on high-strength optimized gears essential for the next generation of mobility.

Manufacturing Process of Transmission Gears

The production of transmission gears is a highly specialized sequence that demands strict metallurgical control to ensure the components can withstand extreme torque and continuous friction. The process involves the following sequential steps:

- 1) Raw Material Preparation:** The process commences with sourcing premium alloy steel selected for its specific metallurgical properties and fatigue resistance. These steel bars are rigorously inspected for material consistency and then cut into precise billets based on the required weight and volume of the final gear.
- 2) Heating and Forging:** The steel billets are heated to optimal forging temperatures within induction furnaces. They are then subjected to immense compressive forces using closed die forging presses, where it shapes the metal into a near net gear blank and aligns the internal grain structure of the steel with the component contours, which maximizes structural integrity and mechanical strength.
- 3) Thermal Softening:** The forged gear blanks undergo controlled cooling and normalizing. This thermal treatment relieves internal stress generated during the heavy forging process, softens the material, and prepares it for precise machining operations.
- 4) Blank Turning:** The softened blanks are machined on computer numerical control lathes. This step establishes the precise outer diameter, inner bore, and face dimensions of the gear before the teeth are cut.
- 5) Gear Teeth Generation:** Specialized machinery is utilized to cut actual gear teeth into the blank. Hobbing is typically used for generating external teeth; shaping or broaching is employed for internal teeth. The edges are then chamfered to remove sharp corners, and gear shaving is performed to refine the tooth profile.
- 6) Heat Treatment:** To withstand continuous wear, the machined gears undergo thermal hardening processes such as carburizing, quenching, and tempering. This creates a highly durable outer surface while preserving a tough and ductile core capable of absorbing sudden shock loads without fracturing.
- 7) Hard Finishing and Shot Peening:** Following heat treatment, the gear teeth undergo profile grinding or honing to achieve exact micro geometry and a superior surface finish, which is essential for minimizing noise and vibration. The gears are then subjected to shot peening, a process that bombards the surface with small metallic spheres to induce compressive residual stresses and significantly enhance overall fatigue life.
- 8) Quality Inspection:** Every finished gear undergoes rigorous testing using coordinate measuring machines and metallurgical evaluation. Components are inspected for dimensional accuracy, surface finish, and subsurface integrity to ensure complete compliance with strict automotive standards before dispatch.

Manufacturing Process of Transmission Shafts

The production of transmission shafts requires distinct machining and finishing operations tailored to their structural role as the rotational axis of the transmission system. The process involves the following sequential steps:

1) Raw Material Preparation: Premium alloy steel bars are sourced and inspected for structural consistency. The steel is then cut into precise billets calculated to meet the exact length and volume requirements of the transmission shafts

2) Heating and Forging: The billets are heated to optimal temperatures and placed into closed die forging presses. The forging process applies immense pressure to create the stepped profile of the shaft. Crucially, this operation aligns the internal grain flow of the metal along the structural axis of the shaft, providing the exceptional torsional strength required to transfer engine power.

3) Thermal Softening: The forged shaft blanks are subjected to normalizing or annealing. This controlled thermal process relieves any internal stresses induced by the forging forces and ensures the metal is sufficiently workable for the subsequent machining phases.

4) Profile Turning The forged blanks are mounted on computer numerical control lathes. Precision turning operations are executed to achieve the exact lengths, diameters, and stepped profiles required along the entire axis of the shaft.

5) Spline Generation and Milling Splines: These are the longitudinal ridges that allow the shaft to interlock securely with transmission gears, are generated along specific sections of the shaft through precise cutting or cold rolling processes. Additionally, deep hole drilling is performed for shafts requiring internal oil passages for lubrication, and milling is executed to create keyways.

6) Heat Treatment: The machined shafts undergo rigorous thermal processing, including carburizing, quenching, and tempering. This treatment hardens the exterior surfaces and splines to resist continuous rotational friction, while maintaining a resilient core that can flex slightly under extreme torque without breaking.

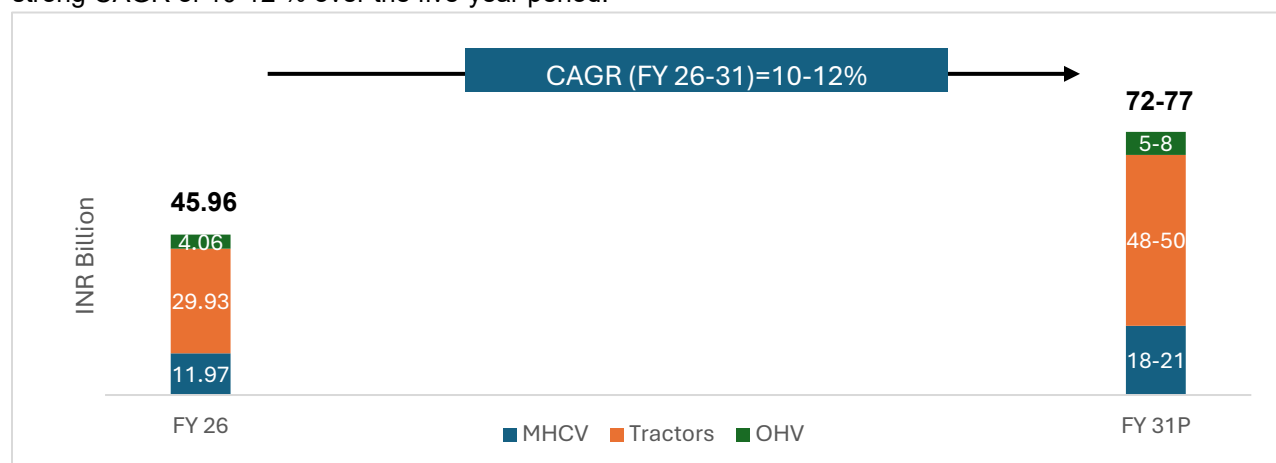
7) Hard Finishing and Shot Peening: The hardened shafts undergo cylindrical grinding to ensure perfect fits for bearings and mating components. Like gears, the shafts are often subjected to shot peening to improve surface strength and maximize long term fatigue resistance under heavy operational loads.

8) Quality Inspection: The final step involves comprehensive quality assurance. The shafts are evaluated using advanced metrology equipment to verify dimensional tolerances, straightness, and spline accuracy. Nondestructive testing methods are also employed to detect any internal anomalies, ensuring only flawless components reach the assembly line.

Review and Outlook of Transmission Gears and Shafts Industry

The market for transmission gears and shafts demonstrates a robust and steady growth trajectory. The market sizing estimation encompasses a comprehensive suite of critical transmission components, including input shafts, layshafts, main shafts, countershafts, speed gears, power take off shafts, and clutch bell housings. The total market size is estimated at 45.96 INR Billion for fiscal 2026. Driven by increasing agricultural mechanization, sustained infrastructure development, and industrial expansion, this market is projected to grow significantly, reaching an estimated 72 to 77 INR Billion by fiscal 2031. This expansion represents a

strong CAGR of 10-12 % over the five-year period.



Includes overall market potential for only MHCV, Tractors and OHV segments

Source: CRISIL Analysis

Tractors constitute the largest and most dominant segment within this market space. The primary reason for this commanding market size is the significantly higher production volume of the domestic tractor industry when compared to the MHCV segment. The market size of tractors segment is estimated to be 29.93 INR Billion in the fiscal 2026, the transmission components market for tractors is anticipated to scale to between 48 and 50 INR Billion by 2031. This substantial market share underscores the heavy reliance on robust gearing systems in agricultural machinery, where components like power take off shafts, intermediate shafts, and durable speed gears are critical for transferring high torque and ensuring operational efficiency in demanding field conditions. Electrification within the tractor segment is also expected to be minimal even by fiscal 2031, hence not impacting the component manufacturers catering in this space.

The IMHCV segment currently contributes 11.97 INR Billion in fiscal 2026 to the overall industry. The transmission and shaft components market for commercial vehicles is forecast to reach 18 to 21 INR Billion by fiscal 2031. This growth is supported by the continuous need for reliable freight and logistics transportation across the country, and with the IMHCV segment growing, the growth of the associated transmission and shaft components will also be supplemented.

Concurrently, the Off Highway Vehicles category exhibits a growth outlook. This segment, which includes construction and mining equipment, relies heavily on exceptionally durable transmission parts to withstand extreme operational stress. The market size for Off Highway Vehicles is expected to grow from 4.06 INR Billion in fiscal 2026 to a projected 5 to 8 INR Billion by 2031, further contributing to the overall demand for precision forged transmission components in India.

Jai Parvati Forge accounted for 2.1% of the Transmission Gears and Shafts market in fiscal 2026 with sales of 96 crores in this segment. The market is estimated to grow from ₹45.96 billion in FY26 to INR 72 billion- INR77 billion by fiscal 2031, at a CAGR of approximately 10%-12%, providing the company with opportunities to expand its presence with its presence across the tractor, medium and heavy commercial vehicle, and off-highway vehicle segments.

Growth Drivers

The growth of the transmission gears and shafts industry in India is propelled by a combination of macroeconomic expansion and specific operational demands within key heavy mobility segments. As the end use industries evolve, the requirement for highly durable, precision engineered forged components continues

to accelerate across Tractors, Medium and Heavy Commercial Vehicles, and Off Highway Vehicles. The primary growth drivers for this market are detailed below.

Increasing Agricultural Mechanization Driving Tractor Volumes

The tractor segment remains the primary volume driver for transmission components in India. Sustained government initiatives promoting farm mechanization, combined with the necessity to improve agricultural yields, ensure robust and continuous tractor production. This agricultural expansion directly translates to increased demand for specialized transmission parts such as power take off shafts, which are essential for transferring engine power to auxiliary farming implements. Furthermore, tractors must navigate diverse and challenging soil conditions, which necessitates the use of highly durable speed gears and intermediate shafts capable of sustaining high torque at very low operational speeds without mechanical failure.

Infrastructure Expansion and Freight Logistics Modernization

The Medium and Heavy Commercial Vehicles segment is experiencing significant growth driven by nationwide infrastructure projects and the rapid expansion of freight logistics networks. The modernization of commercial fleets to handle heavier payloads over longer transit routes requires exceptionally reliable powertrain systems. This operational demand fuels the need for high strength main shafts, input shafts and output flanges.

Surge in Construction and Mining Activities

The Off Highway Vehicles segment, which encompasses heavy construction and earthmoving equipment, is expanding in tandem with increased capital expenditure on large scale infrastructure and mining operations. Vehicles in this category operate in the most severe environments and are routinely subjected to extreme shock loads. Consequently, there is a critical need for heavy duty forged components, including countershafts, layshafts, and robust clutch bell housing. These components are specifically engineered to maintain structural integrity and facilitate seamless torque transfer under immense mechanical strain.

Technological Advancements and Powertrain Efficiency Mandates

Across all three vehicle segments, there is a continuous industry push towards improving fuel efficiency and complying with stringent emission standards. This regulatory and economic pressure drives the adoption of advanced transmission designs. To achieve better fuel economy, manufacturers are increasingly utilizing hollow shafts, which significantly reduce the overall weight of the transmission system while maintaining the necessary torsional strength. Additionally, the demand for precision machined speed gears, input shafts, and spindles is rising. These highly refined components minimize internal friction and vibration, thereby optimizing power transfer from the engine to the wheels and improving the overall efficiency of the vehicle powertrain.

Entry Barriers

The manufacturing of transmission gears and shafts is characterized by significant barriers to entry. These barriers safeguard the market position of established forging manufacturers and restrict the threat of new market participants. The primary challenges for new entrants attempting to supply the heavy mobility sectors are detailed below.

Substantial Capital Expenditure and Infrastructure Requirements

The production of transmission components is a highly capital-intensive process. Establishing a manufacturing facility requires massive investments in heavy machinery, including closed die forging presses, numerical computer-controlled lathes, and specialized heat treatment furnaces. This exceptionally high initial financial investment acts as a severe deterrent for new players attempting to enter the market.

Stringent Original Equipment Manufacturer Approval Processes

Supplying critical powertrain components to established automotive OEMs involves lengthy and rigorous validation cycles. OEMs in the Tractor, Commercial Vehicle, and Off Highway Vehicle segments demand absolute reliability, as the failure of a single layshaft or countershaft can lead to catastrophic transmission breakdowns and costly vehicle downtime. Consequently, new entrants must undergo extensive product testing, quality audits, and long gestation periods before securing vendor approvals. Established forging manufacturers with proven track records and existing relationships possess a distinct and highly defensible competitive advantage in this regard.

Advanced Metallurgical and Manufacturing Expertise

Producing precision transmission parts requires highly specialized technical knowledge that is difficult to replicate. The ability to execute complex machining operations, such as generating precise splines on hollow shafts or achieving exact micro geometry on speed gears, requires years of engineering refinement. Furthermore, mastering thermal treatments like carburizing and surface enhancement techniques like shot peening is essential to ensure components like power take off shafts and input shafts possess the necessary fatigue resistance to handle extreme torque. This steep learning curve prevents inexperienced firms from meeting the exacting metallurgical standards of the heavy mobility industry.

Economies of Scale and Volume Dynamics

Achieving economies of scale is a critical requirement for maintaining competitive pricing, particularly in high volume categories like the domestic tractor and MHCV segment. Established forging manufacturers benefit from large continuous production runs of standard components such as intermediate shafts, main shafts, and spindles, which significantly lowers their per unit manufacturing costs. New entrants typically lack the initial order volumes required to offset their high fixed overheads. This volume disparity makes it challenging for new market participants to compete on price while simultaneously maintaining the strict quality and durability standards demanded by automotive manufacturers.

Module V: Review and Outlook of Reduction Drive Industry

Role of reduction drive components in vehicles

Component	Brief description and function
Bull gears, carburized and induction hardened	Large diameter gears that mesh with bull pinions to reduce rotational speed and increase the torque transmitted to the tractor's drive axle and wheels. Carburizing or induction hardening is undertaken to improve surface hardness, wear resistance and durability under high load conditions.
Bull pinion shafts	Shafts incorporating or carrying a smaller pinion gear that meshes with the bull gear and transfers power from the differential or transmission to the final reduction assembly. The interaction between the bull pinion and bull gear provides the required reduction in speed and increase in torque.

Ring gears	Internally toothed gears forming the outer member of a planetary drive system. Ring gears engage with the planet gears and contribute to the reduction of rotational speed and distribution of torque within the final drive assembly.
Planet gears	Gears positioned between the sun gear and ring gear that rotate on their own axes while revolving around the sun gear. Planet gears distribute the transmitted load across multiple gear contact points and facilitate compact speed reduction and torque multiplication.
Sun shafts and sun gears	Central components of a planetary drive system that receive power from the upstream drivetrain and transmit it to the planet gears. The sun gear meshes with the surrounding planet gears to facilitate speed reduction and torque transfer.
Planetary carriers	Structural components that support the planet gears and their shafts and maintain their relative position within the planetary drive system. Depending on the configuration, the planetary carrier may serve as the output member and transmit the reduced speed and increased torque to the wheel or axle.

The mechanical efficiency of these reduction drive systems directly influences the fuel economy and daily productivity of the tractor. A highly engineered assembly of sun gears, planet gears, and bull gears minimizes power loss during transmission, ensuring that maximum energy is delivered directly to the ground. For farmers and agricultural operators, this translates to lower operational costs and higher yield efficiency. As the agricultural sector increasingly relies on mechanized solutions to improve productivity, the reliance on durable, precision forged reduction drive components that deliver consistent high performance remains a key area in tractor manufacturing.

Manufacturing Process of Reduction Drive Components

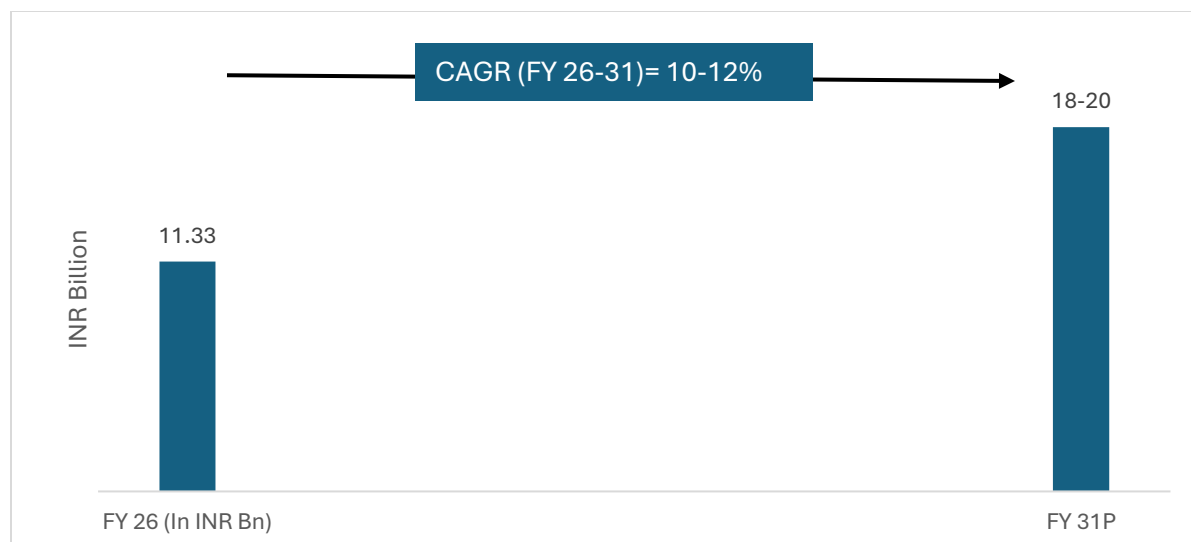
The manufacturing of reduction drive components for agricultural tractors involves a highly controlled sequence of forging, machining, and metallurgical treatments. As these components must endure severe torque and shock loads, the process is designed to maximize structural integrity, wear resistance, and dimensional accuracy.

- 1) **Raw Material Preparation and Heating:** The process begins with the procurement of high-grade alloy steel billets or bars, selected for their specific metallurgical properties. The raw material undergoes stringent quality inspections to ensure it is free from internal defects. The steel is then cut to precise weights and heated in an induction furnace to the optimal forging temperature, making the metal malleable without compromising its inherent strength.
- 2) **Closed Die Forging:** The heated billets are transferred to heavy duty forging presses. Through closed die forging, the metal is compressed into the near net shape of the desired component. This step is critical as it aligns the internal grain structure of the steel with the shape of the part, significantly enhancing its load bearing capacity and fatigue resistance. While sun gears, planet gears, and bull gears are forged into solid blanks, the planetary carrier requires a more complex multistage forging process to accommodate its intricate structural design.
- 3) **Thermal Treatment and Stress Relieving:** Following the forging process, the raw blanks undergo normalizing or isothermal annealing. This controlled cooling process relieves internal stresses generated during forging, refines the grain structure, and softens the material to prepare it for subsequent machining operations.

- 4) **Rough Machining:** The annealed forgings are processed through CNC turning centers. In this phase, the excess material is removed to achieve the basic dimensional profile of the component. Operations such as facing, turning, and boring are performed to prepare the blanks for gear teeth generation.
- 5) **Gear Teeth Generation and Component Specific Machining:** This stage involves specialized machining based on the function and geometry of the individual component:
 - Sun Gears, Planet Gears, and Bull Gears: These components undergo gear hobbing or milling to cut external teeth into the forged blanks.
 - Ring Gear: Because the teeth are located on the inner diameter, the ring gear requires internal gear shaping or broaching to accurately cut the internal splines and teeth.
 - Planetary Carrier: Unlike the gears, the carrier does not require teeth generation. Instead, it undergoes precision drilling and boring to create exact housing points for the planet gear pins, ensuring perfect alignment for the planetary assembly.
- 6) **Advanced Heat Treatment:** Heat treatment is essential to provide the components with a hard, wear resistant surface while maintaining a tough, ductile core to absorb shock. The treatment varies based on the component:
 - Planetary Drive Parts (Sun, Planet, and Ring Gears): These typically undergo gas carburizing, quenching, and tempering. This process diffuses carbon into the surface layer, creating a uniform hardened case around the gears.
 - Bull Gear: Given its role in the final reduction stage and the immense torque it handles, the bull gear undergoes a specialized dual process. It is first carburized and then subjected to localized induction hardening. This targets the gear teeth specifically, providing an exceptionally deep and hardened wear surface while preserving the structural toughness of the gear body.
- 7) **Hard Machining and Gear Finishing:** After heat treatment, the components undergo hard turning and precision grinding. Gear grinding is performed on the teeth of the sun, planet, and bull gears to achieve exact involute profiles and superior surface finishes. This precision is vital to minimize friction, reduce operational noise, and ensure smooth power transmission within the tractor axle.
- 8) **Surface Finishing and Final Inspection:** In the final stage, components are subjected to shot peening, a process that bombards the surface with metallic media to induce compressive residual stresses, further enhancing fatigue life. The finished parts then undergo rigorous final inspections, including coordinate measuring machine dimensional checks, metallurgical evaluations, and non-destructive testing such as magnetic particle inspection to ensure no surface cracks are present before dispatch.

Review and Outlook of Reduction Drive Industry

The reduction drive component market for the agricultural tractor segment is poised for substantial expansion over the next five years. Reviewing the current market landscape, the current market size is 11.15 INR Billion in fiscal 2026. Driven by consistent demand and evolving agricultural practices, this market is projected to grow steadily, reaching an estimated 18-20 INR Billion by the fiscal 2031. This expansion represents a robust CAGR of 10-12% the projected period. The consistent upward trajectory underscores the critical nature of reduction drives in the industry.



Includes overall market potential for only Tractors

Source: CRISIL Analysis

Several key growth drivers are supplementing this positive market outlook. Foremost is the increasing rate of global and domestic farm mechanization aimed at enhancing agricultural yield and mitigating the challenges posed by rural labor shortages. As farmers seek greater operational efficiency, there is a distinct shift in consumer preference toward higher horsepower tractors. These powerful machines are essential for operating heavy agricultural implements and require highly durable planetary and final reduction drives to effectively manage increased torque outputs without mechanical failure. Consequently, the demand for precision forged reduction components like bull gears, ring gears, and planetary carriers is escalating in tandem with the production of tractors. Since the tractor industry is expected to grow at a CAGR of 4-6% over the next 5 years, the demand from new volumes and additionally from the increasing complexity and price of components over the next 5 years.

Approximately 65% of tractors sold in India in Fiscal 2025 are estimated to use bull gear-based reduction systems, while the remaining 35% employ planetary or internal ring gear-based reduction systems. The share of bull gear-based systems is expected to increase to approximately 75% by Fiscal 2031, with the share of planetary or internal ring gear-based systems moderating to approximately 25%. Accordingly, this shift is expected to support demand for bull gears and bull pinion shafts, while relatively moderating the growth potential for sun gears or sun shafts, planet gears, internal ring gears and planetary carriers used in planetary reduction systems.

Furthermore, favorable government initiatives and agricultural subsidies designed to modernize the farming sector continue to stimulate tractor sales, thereby creating a sustained pipeline of demand for OEMs and their component suppliers. The growing emphasis on reducing maintenance downtime and improving the total cost of ownership for farmers also compels tractor manufacturers to source robust reduction drive parts that offer enhanced fatigue resistance and operational longevity. The necessity to transmit power efficiently to the ground while minimizing fuel consumption further drives the adoption of highly engineered reduction systems. Together, these factors create a highly conducive environment for the sustained growth and technological advancement of the reduction drive industry through the end of the decade.

Jai Parvati Forge specializes in the manufacture of bull gears and holds an estimated 17.4% share based on value and 18.4% share based on volume of the Bull Gears market in fiscal 2026, demonstrating its longstanding presence and established position in the tractor segment.

Growth Drivers

Accelerating Pace of Farm Mechanization

The primary catalyst propelling the demand for reduction drive components is the rapid adoption of mechanized farming. As the agricultural sector globally and domestically grapples with acute rural labor shortages and the pressing need to enhance crop yields, farmers are increasingly relying on tractors for continuous, daily operations. This intensive usage subjects the vehicle drivetrain to prolonged mechanical stress. Consequently, there is a sustained volume demand for precision forged planetary drive parts, specifically sun gears and planet gears, which must maintain exceptional fatigue resistance to ensure seamless power transmission over long operational hours. The structural integrity of these specific components is critical to preventing premature wear during continuous field operations, making them indispensable to the mechanization trend.

Transition Toward High Horsepower Tractors

Modern agricultural practices increasingly rely on heavy implements for deep ploughing, precision tilling, and heavy haulage. Operating these heavy duty implements requires tractors capable of generating immense tractive force at the wheels. This elevated torque output places extreme mechanical stress directly on the final reduction stage of the vehicle. As a result, there is a heightened demand for structurally superior bull gears and bull pinion shafts. To withstand these extreme shear forces without failing, these specific components require advanced manufacturing processes, including dual heat treatments like carburizing and induction hardening. Furthermore, planetary carriers must be forged with high precision to maintain the exact alignment of the planet gears under severe load. This shift toward high horsepower machines not only increases the volume of reduction drives required but also drives higher value realization for these complex, heavily engineered parts.

Favorable Government Policies and Export Market Expansion

Various agricultural subsidies, easy credit availability, and rural development programs continue to empower farmers to upgrade to modern tractors, bolstering domestic sales. Simultaneously, the emergence of domestic manufacturing hubs as global export bases for agricultural equipment has significantly expanded the total addressable market. Tractors exported to diverse geographies encounter a wide variety of harsh soil conditions, which subject the drivetrain to unpredictable shock loads. This global expansion necessitates the use of highly durable ring gears and robust planetary assemblies that comply with stringent international metallurgical standards. Original equipment manufacturers are compelled to source premium forged components that guarantee reliability and warranty compliance across varied global terrains, thereby expanding the market footprint for specialized reduction drive manufacturers.

Focus on Total Cost of Ownership and Operational Efficiency

The growing emphasis on reducing the total cost of ownership is driving technological advancements and quality upgrades within the component manufacturing space. Farmers and fleet operators demand tractors that offer superior fuel efficiency and minimal maintenance downtime. The mechanical efficiency of the reduction drive plays a direct role in achieving these metrics. Precision gear teeth generation and advanced surface finishing on sun, planet, and bull gears significantly reduce internal friction and minimize transmission power loss. This ensures maximum engine power is delivered to the ground, directly improving fuel economy. Additionally, utilizing wear resistant gear profiles and robust planetary carriers reduces the frequency of mechanical breakdowns. By lowering maintenance costs and extending the operational lifespan of the tractor, these highly engineered components directly optimize the total cost of ownership, solidifying their importance in modern tractor design.

Entry Barriers

Capital Intensive Manufacturing Infrastructure

The manufacturing of reduction drive components is a highly capital-intensive process that requires substantial initial investments in heavy machinery. Producing critical parts such as bull gears and planetary carriers necessitate advanced closed die forging presses, precision computer numerical control machining centers, and specialized gear cutting equipment. Furthermore, the requirement for complex thermal processing, such as the dual carburizing and induction hardening processes specifically needed for bull gears, demands expensive heat treatment furnaces. For a new entrant, establishing this sophisticated manufacturing infrastructure involves prohibitive capital expenditure, creating a formidable financial barrier to market entry.

Stringent Metallurgical and Precision Engineering Standards

Reduction drives operate under extreme torque and continuous shock loads within the tractor drivetrain, mandating uncompromising structural integrity. Developing components like sun gears, planet gears, and ring gears require deep metallurgical expertise to ensure optimal grain flow during the forging process. Additionally, achieving the exact involute profiles and internal splines for ring gears requires exceptional precision engineering capabilities. The planetary carrier, which holds the entire planetary assembly together, demands absolute dimensional accuracy to ensure perfect alignment of the planet gear pins. Acquiring this highly specialized technical knowledge and mastering the intricate manufacturing processes takes years of operational experience, effectively deterring new players lacking an established engineering pedigree.

Protracted OEM Approval Cycles

The agricultural tractor industry operates on stringent quality validations, given that drivetrain failures lead to catastrophic vehicle breakdowns and severe reputational damage for the brand. Consequently, OEMs subject new suppliers to rigorous and time-consuming testing protocols before integrating their components into the final reduction or planetary drive assemblies. A new manufacturer attempting to supply critical load bearing parts like bull pinion shafts or planetary gear sets must undergo extensive field trials, metallurgical audits, and fatigue testing that can span several years. This protracted validation and approval cycle requires new entrants to sustain operations without immediate revenue generation, serving as a significant barrier to establishing a foothold in the industry.

Economies of Scale and Supply Chain Optimization

Established manufacturers of reduction drive components benefit immensely from economies of scale, allowing them to produce high volumes of precision parts at competitive prices. The continuous production of standardized components such as planet gears and sun gears enables incumbent players to amortize their high fixed costs effectively. Furthermore, these established entities possess deeply integrated supply chains, ensuring the consistent and cost-efficient procurement of the high grade alloy steel required for forging. A new entrant would find it challenging to match the pricing power and supply chain resilience of legacy manufacturers, making it exceedingly difficult to secure bulk orders from major tractor manufacturers and achieve the scale necessary for long term profitability.

Module VI: Review and Outlook of Axle and Chassis Levers Industry

Role of axle and chassis levers components in vehicles

Component	Brief description and function
Relay drop arms	Lever components connected to the steering gear or relay mechanism that transmit steering movement to the steering linkage. These components convert the rotary movement of the steering gear output shaft into linear movement of the connected steering rods.
Track rod levers	Lever components connected to the steering knuckles that receive movement from the track rod and facilitate the turning of the wheels. These components assist in transmitting steering forces between the track rod and the wheel steering assemblies.
Steering levers	Forged lever components that transmit movement from the drag link or other steering linkage to the steering knuckle, thereby creating the turning movement required to steer the wheels.
Steering knuckle assemblies	Structural steering and suspension components that support the wheel hub and provide a pivot point around which the wheels turn. These assemblies connect the steering linkage with the wheel and suspension system and facilitate directional control of the vehicle.
Bell crank lever assemblies	Pivoted lever assemblies that receive movement from one steering linkage and transmit it to another linkage, generally by changing the direction of the applied motion. These assemblies are used where the arrangement of the steering system requires steering force to be redirected between connecting rods.
Equalizer rod assemblies	Linkage assemblies that transmit and distribute steering movement across connected steering components to support coordinated movement of the wheels. These assemblies assist in maintaining the required relationship between the steering movements on either side of the vehicle.

Given the severe operating environments and the safety critical nature of axle and chassis linkages in the commercial and tractors, the manufacturing process of these components is of paramount importance. Forging stands as the most viable manufacturing technology for these parts, as it imparts superior metallurgical properties, exceptional fatigue resistance, and a highly refined directional grain flow that aligns with the stress contours of the component. Unlike casting or machining, the forging process eliminates internal voids and porosity, resulting in levers and knuckles that possess the ultimate tensile strength required to withstand continuous shock impacts and heavy load cycles. Consequently, OEMs rely heavily on high quality forged axle and chassis components to guarantee operational longevity, minimize vehicle downtime, and ensure uncompromising safety for fleet operators and farmers alike.

Manufacturing Process of Axle and Chassis Lever Components

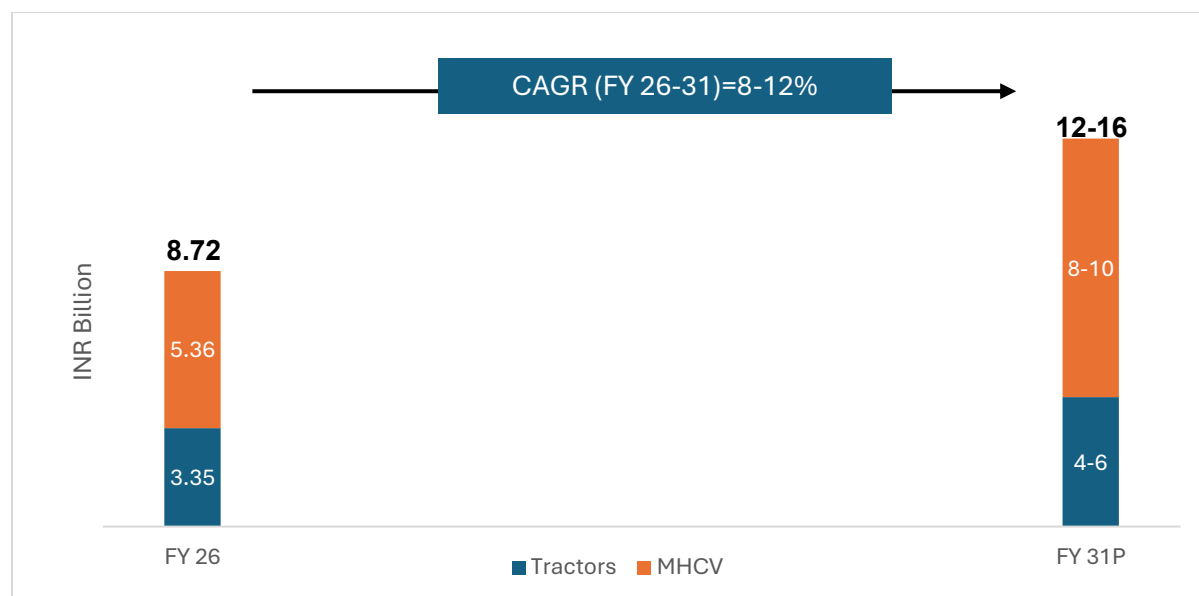
- 1) **Raw Material Procurement and Metallurgical Evaluation:** The manufacturing process for critical axle and chassis components begins with the careful procurement of high-grade alloy steel. This material is selected specifically for its superior mechanical properties and its ability to withstand the severe operational stresses inherent in Medium and Heavy Commercial Vehicles and agricultural tractors. Before entering the production cycle, the raw material is subjected to rigorous metallurgical evaluation to ensure it meets the stringent standards required for safety critical linkages such as the relay drop arm and track rod lever.
- 2) **Billet Heating and Thermal Preparation:** The core of the manufacturing lifecycle initiates by heating the steel billets to precise temperatures. This thermal preparation achieves optimal plasticity without compromising the internal material structure. Proper heating ensures that the metal can be seamlessly molded during the subsequent pressing stages, which is vital for maintaining the structural integrity required for heavy transportation and rigorous farming activities.
- 3) **Closed Die Forging and Grain Flow Alignment:** The heated billets are shaped using massive, closed die forging presses. This method is particularly crucial for forming the complex geometries of the steering knuckles assembly and the bell crank lever assembly. The immense pressure applied forces the metal to conform exactly to the die cavities, thereby aligning the internal grain structure of the steel with the external contours of the part. This continuous grain flow grants these levers exceptional fatigue resistance and impact strength.
- 4) **Advanced Heat Treatment:** Following the primary forging stage, the components undergo a series of specialized heat treatment processes, including quenching and tempering. This precise thermal management optimizes their mechanical properties, achieving the perfect equilibrium between surface hardness for wear resistance and core toughness. Such toughness is essential to absorb dynamic shock loads from rugged terrains commonly navigated by MHCVs and tractors.
- 5) **Precision CNC Machining:** Once the desired metallurgical state is achieved, the forged blanks are transitioned to advanced computerized numerical control machining centers. Here, the parts are machined to exact dimensional tolerances. This precision is especially critical for assembly components like the equalizer rod assembly and steering lever, where flawless fitment is required to ensure seamless integration with the broader vehicle chassis and steering systems\
- 6) **Comprehensive Quality Assurance and Non Destructive Testing:** The final phase involves rigorous quality assurance protocols, reflecting the zero tolerance for failure in commercial and agricultural vehicle components. Each forged lever and assembly is subjected to non-destructive testing, such as magnetic particle inspection and ultrasonic testing, to detect any microscopic surface or internal anomalies. Dimensional accuracy is further verified using advanced coordinate measuring machines to ensure exact compliance with original equipment manufacturer specifications.

Review and Outlook of Axle and Chassis Components

The axle and chassis components market for commercial vehicles and tractors is positioned for robust growth, projected to expand at a CAGR of 8-12% from fiscal 2026 to fiscal 2031. The growth in the commercial vehicle

segment is primarily driven by continuous government investments in infrastructure and national highway projects, which elevate the demand for heavy duty transport. Furthermore, the rapid expansion of the logistics sector necessitates fleet modernization. Fleet operators are prioritizing reliable vehicles equipped with robust forged components to maximize operational efficiency, while stringent vehicle scrappage and emission norms further accelerate replacement cycles.

The tractor segment is expected to grow at a CAGR of 5-7%, whereas the MHCV segment is estimated to grow at 9-12% during the same period.



Includes overall market potential for only MHCVs and Tractors

Source: CRISIL Analysis

Parallel to this, the tractor segment is propelled by the critical need for farm mechanization to counter labor shortages and improve crop yields. Government subsidy programs supporting rural infrastructure strongly incentivize tractor purchases. Additionally, a notable shift towards higher horsepower tractors for heavy agricultural implements directly increases the reliance on highly durable forged steering and suspension linkages.

JPF's standalone market share in the tractor steering knuckles segment was 12.4% in Fiscal 2026, with revenue of INR 0.27 billion in an estimated market of INR 2.22 billion. Following the acquisition of DS Engineers, effective April 1, 2026, JPF's pro forma consolidated market share increased to 32.2%, corresponding to revenue of INR 0.72 billion, thereby strengthening its position in the tractor axle and chassis components market

Growth Drivers

Infrastructure Development and Construction Projects

Sustained government investments in large scale infrastructure and national highway projects serve as a primary catalyst for market expansion. This continuous development necessitates a robust fleet of medium

and heavy commercial vehicles, directly driving the demand for durable forged axle and chassis components capable of withstanding extreme operational stresses.

Accelerated Farm Mechanization

A critical push towards comprehensive farm mechanization is currently underway, driven primarily by acute agricultural labor shortages. The pressing need to maximize crop yields to support a growing population compels farmers to invest heavily in modern tractors, thereby driving the demand for durable forged steering and suspension linkages.

Expansion of Logistics and Electronic Commerce

The rapid growth of the logistics sector requires fleet operators to maintain high vehicle uptime and operational efficiency. Fleet modernization is essential to meet the fast-paced demands of organized retail, increasing the reliance on high strength forged linkages that ensure safety and longevity under heavy payload conditions.

Shift Towards Higher Horsepower Tractors:

There is a distinct market transition towards higher horsepower tractors designed to operate heavy duty implements across challenging terrains. These powerful machines demand exceptionally resilient steering and chassis components to maintain traction and maneuverability, positioning forging manufacturers to benefit significantly from this continuous agricultural modernization.

Entry Barriers

High Capital Expenditure Requirements:

The heavy forging industry is exceptionally capital intensive. Establishing a state-of-the-art manufacturing facility requires massive upfront investments in heavy closed die forging presses, advanced computerized numerical control machining centers, and sophisticated heat treatment furnaces. New entrants face significant financial hurdles to procure this specialized equipment and build the necessary infrastructure to compete effectively with established players.

Stringent OEM Approvals:

Axle and chassis levers are safety critical components that directly dictate the structural integrity and handling of commercial vehicles and tractors. Consequently, OEMs enforce rigorous and lengthy validation processes before approving a new supplier. This complex approval cycle involves extensive metallurgical testing, prototype development, and prolonged field trials, acting as a significant barrier for new companies attempting to penetrate the supply chain.

Advanced Technical and Metallurgical Expertise:

Manufacturing high strength forged components requires deep technical expertise in metallurgy, precision die design, and thermal management. Achieving the exact continuous grain flow necessary for maximum fatigue resistance in heavy duty applications is a highly complex engineering challenge. Established manufacturers possess decades of accumulated proprietary knowledge and skilled engineering teams, making it difficult for new entrants to replicate this level of precision and reliability.

High Switching Costs and Established Relationships:

OEMs typically prefer to maintain long-term strategic partnerships with proven forging suppliers to ensure supply chain stability and consistent product quality. Because the cost of component failure in the commercial

and agricultural segments is exceptionally high, buyers are highly reluctant to switch to unproven vendors. This strong loyalty significantly restricts market access to new competitors.

Economies of Scale and Competitive Pricing:

Incumbent forging manufacturers benefit from deeply established economies of scale, allowing them to optimize production costs, secure favorable raw material pricing, and offer highly competitive rates to their clients. New entrants, lacking the initial production volume required to absorb high fixed operational costs, struggle to achieve price parity. This financial dynamic makes it exceedingly challenging for new players to capture market share without sustaining initial financial losses.

Long Gestation Periods for Product Development:

The lifecycle from initial component design to commercial mass production is notably long in the automotive forging sector. Developing specialized steering knuckles or equalizer rod assemblies requires extensive tooling preparation and iterative testing. This extended gestation period delays revenue generation for new entrants, requiring them to possess substantial financial holding power to survive the initial years of operation.

Module VII: Review and Outlook of Hydraulic Components Industry

Role of Hydraulic components in Tractors

Component	Brief description and function
Lift arms	Linkage components that connect the tractor's hydraulic lifting mechanism to the attached implement and transmit lifting force to raise, lower and maintain the implement at the required operating position.
Rocker arms	Pivoted lever components forming part of the tractor's hydraulic lift mechanism. These components transmit movement from the hydraulic lift shaft or actuator to the lift arms, thereby facilitating the raising and lowering of the attached implement.
Response valves	Hydraulic control components that regulate the flow of hydraulic fluid within the lift system and control the rate at which an attached implement is lowered or responds to changes in operating conditions. These valves support controlled implement movement and help prevent sudden lowering of the implement.

The importance of hydraulic parts in tractors extends beyond operational efficiency. These components are designed to withstand demanding working conditions, offering durability and reliability that are crucial for minimizing downtime and maintenance costs. As the tractor industry continues to modernize, the demand for robust and high-performance hydraulic components in tractors is expected to rise, underscoring their pivotal role in supporting the evolving needs of farmers and the broader agricultural ecosystem.

Manufacturing Process of Hydraulic Components

1) Raw Material Preparation: The process begins with the procurement of high-grade steel alloys selected for their load-bearing capabilities. The raw steel billets are inspected for metallurgical consistency, cut to specific weights, and heated in induction furnaces to optimal forging temperatures.

2) Closed Die Forging: The heated billets are transferred to forging presses where they are shaped into the near-net forms of the lift arms, rocker arms, and valve bodies. This forging process aligns the grain structure of the metal to the shape of the component, significantly enhancing its structural integrity and fatigue resistance.

3) Heat Treatment The forged blanks undergo thermal processing, such as normalizing, quenching, and tempering. This critical step relieves internal stress from the forging process and optimizes the mechanical properties of the steel, ensuring the components possess the necessary hardness and tensile strength to withstand high hydraulic pressures and heavy agricultural loads.

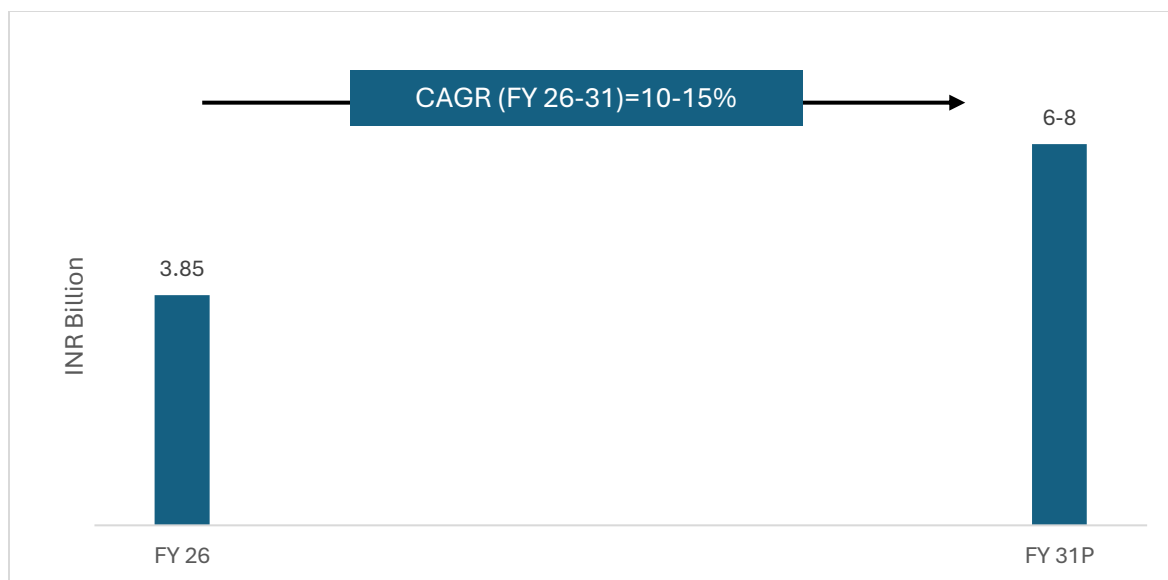
4) Precision Machining The heat-treated forgings are processed using advanced Computer Numerical Control (CNC) machinery. Operations such as milling, turning, and drilling are performed to achieve exact dimensional tolerances. This step is particularly critical for response valves, which require highly precise internal geometries to regulate hydraulic fluid flow accurately.

5) Surface Finishing: To protect against the harsh and corrosive environments typical of agricultural operations, the machined components undergo surface treatments. This typically involves shot blasting to remove scale, followed by anti-corrosive plating, painting, or specialized coatings.

6. Quality Assurance and Testing The final components are subjected to rigorous quality control protocols. This includes dimensional inspections using coordinate measuring machines (CMM) and non-destructive testing (NDT) to detect any internal or surface flaws. The components are also tested for pressure tolerance and structural soundness before final dispatch.

Review and Outlook of Hydraulic Components Industry

The market for hydraulic components is INR 3.85 billion in fiscal 2026. This market is poised for robust expansion over the medium to long term. The market is expected to scale up to INR 6-8 billion by fiscal 2031 at a CAGR of 10-15% during the five-year period. This steady upward trend underscores the growth of the agricultural tractor segment.



Includes overall market potential for only for Tractors segment

Source: CRISIL Analysis

This projected growth is underpinned by several key industry drivers. Primarily, the accelerating pace of farm mechanization and the global push for higher agricultural productivity are increasing the demand for reliable tractor equipment. As farmers increasingly adopt heavier and more complex implements to optimize crop yields, there is a corresponding shift towards higher horsepower tractors that require sophisticated, high-capacity hydraulic systems. Furthermore, supportive government initiatives aimed at modernizing agricultural infrastructure, coupled with a steady replacement demand for durable forged parts, are expected to sustain this momentum. Consequently, manufacturers supplying critical hydraulic linkages and valves are well positioned to capitalize on these structural industry tailwinds.

JPF manufactures hydraulic parts as part of its product portfolio; however, revenue attributable specifically to these products is not separately tracked. The company's capabilities in this segment position it to address demand for hydraulic components across its served end-user industries.

Growth Drivers

Increasing Adoption of Heavier Agricultural Implements

As farming practices modernize to maximize yield efficiency, tractors are frequently required to operate with larger attachments such as reversible ploughs and heavy rotavators. This shift directly necessitates higher hydraulic lifting capacities. Consequently, there is a surging demand for structurally superior, forged lift arms and hydraulic rocker arms that can withstand immense mechanical stress and deliver reliable load bearing performance.

Advancements in Precision Agriculture and Draft Control

Modern tractors increasingly feature automated draft control mechanisms designed to maintain uniform implement depth across uneven terrains. This functionality relies entirely on the rapid and accurate regulation of hydraulic fluid, which is governed by precision engineered response valves. As farmers seek greater

operational accuracy and reduced fuel consumption, the integration of these highly responsive valves becomes an indispensable requirement, accelerating their market demand.

Preference for Forged Durability and Structural Integrity

The harsh and abrasive nature of agricultural environments dictates a strong preference for forged hydraulic components over casted alternatives. The superior fatigue resistance offered by the forging process ensures longer lifespans for critical linkages like lift and rocker arms. This inherent need for durability, coupled with a steady aftermarket replacement cycle for wear intensive parts, provides a continuous and reliable growth avenue for manufacturers specializing in these components.

Entry Barriers

High Capital Expenditure and Infrastructure Requirements

Setting up a specialized forging facility for heavy duty tractor components requires substantial initial capital investment. Prospective entrants must invest heavily in heavy forging presses, induction furnaces, and advanced CNC machining centers. The specialized infrastructure required to manufacture robust lift arms and hydraulic rocker arms, alongside the highly precise equipment needed for response valves, creates a significant financial hurdle for new players.

Stringent OEM Validation and Long Gestation Periods

Tractor OEMs enforce rigorous quality, durability, and safety standards for load bearing hydraulic parts. Critical components like lift arms and response valves must undergo extensive field testing and validation cycles before securing vendor approval. This long gestation period, combined with the reluctance of OEMs to switch away from proven and reliable suppliers, makes it highly challenging for unproven entrants to penetrate the market.

Advanced Metallurgical and Precision Engineering Expertise

Manufacturing reliable hydraulic components demands deep technical expertise that is difficult to replicate. Producing forged rocker arms and lift arms require precise control over thermal processing and closed die forging to align metal grain structures for maximum fatigue resistance. Similarly, response valves necessitate micro level machining tolerances to ensure flawless hydraulic fluid regulation. Acquiring and retaining this specialized engineering talent serves as a strong deterrent for new competitors.

Economies of Scale and Cost Competitiveness

Established forging manufacturers benefit from significant economies of scale, allowing them to procure raw materials, such as high-grade steel alloys, at competitive prices while optimizing production overheads. New entrants, lacking these volume advantages, often struggle to match the pricing and operational efficiencies of incumbent players. This cost disadvantage makes it difficult for new manufacturers to offer competitive pricing without compromising on the stringent quality requirements of tractor hydraulic systems.

Module VIII: Review and Outlook of 4WD Axle Components Industry

Role of 4WD Axle components in Tractors

The agricultural machinery sector is witnessing a structural shift towards the adoption of four-wheel-drive tractors, driven by the need for enhanced traction, reduced soil compaction, and superior operational efficiency. The front axle assembly in a 4WD tractor is a highly engineered system designed to deliver power, support substantial structural loads, and facilitate precise steering under severe operating conditions. The reliability and performance of this system are heavily dependent on the structural integrity of its core components, which must withstand continuous heavy-duty cycles in rugged farming environments.

The transmission of power from the tractor's primary gearbox to the front axle is facilitated by the main shaft. This central drive shaft is the critical link that enables four-wheel-drive capability, providing the essential traction required when operating in muddy, uneven, or loose soil conditions. Upon reaching the front differential, the rotational power is transferred to the Ring Gear. The Ring Gear plays a pivotal role in changing the direction of the power flow by ninety degrees towards the wheels while simultaneously providing significant gear reduction. This torque multiplication is vital in agricultural applications, as it generates the heavy pulling power necessary for tillage, towing, and the operation of heavy implements.

From the differential, the torque is transmitted outward to the wheels through the Wheel Shaft. In a 4WD tractor, the wheel shaft must continuously deliver high levels of torque while accommodating the articulation required for steering. This dynamic operating environment demands exceptional torsional strength and fatigue resistance to prevent failure under heavy loads. Working in tandem with the steering mechanism is the King Pin, which serves as the primary pivot point for the steering assembly. Tractors frequently bear immense front-end loads, particularly when equipped with front loaders or heavy engine blocks. The king pin is engineered to withstand these extreme vertical and lateral forces, ensuring smooth maneuverability and precise directional control across uneven agricultural terrains.

The final stage of power delivery and structural support is managed by the Wheel Carrier Hub. This component acts as the foundational mounting point for the wheels and houses the critical bearing assemblies. The wheel carrier hub not only transfers rotational torque from the wheel shaft directly to the tires but also bears a significant portion of the tractor's dynamic weight, ensuring stable and frictionless wheel rotation.

Component	Brief description and function
Ring gears	Large diameter gears that mesh with the corresponding pinion or planetary gears to transmit torque and provide the required speed reduction within the axle assembly. In a differential arrangement, the ring gear receives power from the drive pinion and transfers it to the differential and axle shafts.
Steering knuckle kingpins	Heavy duty pins that connect the steering knuckle to the front axle assembly and provide the pivot axis around which the wheel and steering knuckle turn. These components support steering movement while withstanding the loads transmitted through the front axle.

Wheel shafts	Rotating shafts that transmit torque from the axle or final reduction assembly to the wheel hub and, consequently, to the front wheels. These shafts facilitate power delivery to the wheels when the four-wheel drive system is engaged
4WD main shafts	Principal shafts within the four-wheel drive axle or drive arrangement that receive and transmit power across the axle assembly. These components support the transfer of torque from the upstream drivetrain to the differential, reduction gear arrangement or wheel drive components.
Wheel carriers	Structural components that support and position the wheel hub, bearings and associated axle components. Wheel carriers facilitate the connection of the wheel assembly to the axle and help maintain the alignment required for steering and wheel rotation.
Wheel hubs	Components fitted at the wheel end of the axle that provide the mounting interface for the wheel and house or support the wheel bearings. In a driven axle, wheel hubs also receive torque from the axle or wheel shaft and transfer it to the wheels.

Given the extreme operational stresses, including continuous heavy loads, high torque requirements, and harsh environmental exposure, the manufacturing quality of these axle components is of paramount importance. Forged components are indispensable in this application due to their superior metallurgical grain structure, which offers enhanced tensile strength, impact resistance, and longevity compared to cast alternatives. The durability of these critical axle parts directly dictates the operational uptime of the tractor, making them fundamental to the overall productivity and total cost of ownership for the farming community.

Manufacturing Process of 4WD Axle Components

- 1) Procurement and inspection of raw materials:** Alloy steel bars, billets, forged blanks or castings of the specified grades are procured, depending on the design and functional requirements of the respective components. The raw materials are inspected for chemical composition, mechanical properties, dimensions and surface defects.
- 2) Cutting and blank preparation:** Bars and billets are cut into the required sizes. The cut material is heated and forged to obtain the approximate shape of the relevant component. The wheel carrier hub may alternatively be manufactured from casting, depending on its design and application.
- 3) Trimming and surface cleaning:** Excess material, forging flash, runners and risers, as applicable, are removed. The component blanks are thereafter subjected to shot blasting or an equivalent cleaning process to remove scale, sand and other surface impurities.
- 4) Preliminary heat treatment:** The forged or cast blanks are normalized, annealed or stress relieved, as applicable, to refine the material structure, reduce residual stresses and improve machinability.
- 5) Rough machining:** The component blanks are subjected to turning, facing, boring and other machining operations to establish the principal diameters, bores, shoulders, flange faces and reference surfaces. Adequate machining allowance is retained for subsequent heat treatment and finishing operations.
- 6) Formation of functional features:** Gear teeth, splines, grooves, lubrication passages, mounting holes, threads and other functional features are produced through hobbing, shaping, milling, broaching, spline rolling, drilling or tapping, depending on the configuration of the relevant component. Ring gear teeth are generally generated through suitable gear cutting processes such as face milling or face hobbing.

7) Heat treatment: The machined components are subjected to carburizing, case hardening, induction hardening or through hardening, followed by quenching and tempering, as applicable. This process provides the required surface hardness, wear resistance, case depth and core strength.

8) Cleaning and straightening: Scale and residues arising from heat treatment are removed through shot blasting or washing. Shaft-type components are checked for distortion and straightened, where required, to maintain the specified straightness and runout.

9) Finish machining and grinding: Critical surfaces, including bearing seats, bores, oil seal areas, mounting faces, journals and other functional locations, are finished, turned, bored or ground to achieve the required dimensional accuracy, geometrical tolerances and surface finish.

10) Gear and spline finishing: Gear teeth and splines are subjected to grinding, lapping, honing or other finishing operations, where required, to obtain the specified tooth profile, contact pattern, fit and surface quality.

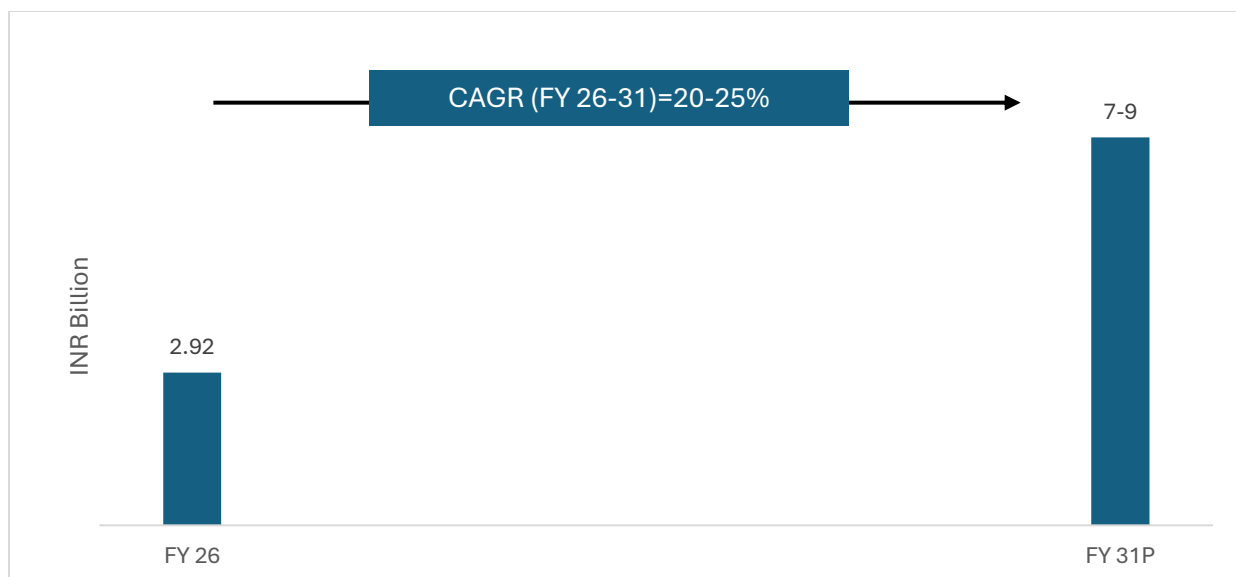
11) Deburring and component cleaning: Burrs and sharp edges generated during machining are removed. The components are washed and cleaned to eliminate metal chips, abrasive particles, oil and other contaminants.

12) Quality inspection and testing: The components are inspected for dimensional accuracy, surface finish, straightness, concentricity, runout, gear and spline geometry, hardness and case depth. Non-destructive testing, metallurgical examination and crack detection may also be undertaken based on customer specifications and component criticality.

13) Surface protection: The accepted components are phosphated, painted, blackened or coated with rust preventive material, as applicable, to provide protection against corrosion during storage and transportation.

Review and Outlook of 4WD Axle Components Industry

The market for critical 4WD axle components is poised for robust expansion over the medium to long term, reflecting a structural transformation within the agricultural machinery sector. The market size of 4WD front axle components is projected to grow from INR 2.92 billion in fiscal 2026 to an estimated range of INR 7- 9 billion by fiscal 2031. This trajectory represents a CAGR of 20 to 25%.



Includes overall market potential for only 4WD Tractors

Source: CRISIL Analysis

The primary catalyst underpinning this exponential growth is the aggressive upward trend in 4WD tractor penetration across the Indian market. Historically dominated by 2WD models, the Indian agricultural landscape is experiencing a decisive shift as farmers increasingly recognize the operational superiority of 4WD systems. These advanced tractors offer enhanced traction, reduced wheel slippage, and superior weight distribution. Such attributes are critical for operating in challenging terrains, including deep mud, wet paddy fields, and uneven topographies. Furthermore, the modern Indian farmer is rapidly adopting heavy agricultural implements such as rotary tillers, laser levelers, and front-end loaders. The effective operation of these heavy implements necessitates higher torque, pulling power, and front-end stability that only a 4WD axle assembly can provide.

Beyond the direct need for enhanced traction, the broader push towards farm mechanization is acting as a significant macroeconomic tailwind. Persistent agricultural labor shortages and the imperative to increase crop yields per hectare are compelling farmers to upgrade to higher horsepower tractors. These higher horsepower machines inherently rely on 4WD configurations to effectively translate engine power to the ground without causing excessive soil compaction. Additionally, supportive government initiatives promoting mechanization, coupled with improved access to rural credit and financing, are empowering farmers to invest in these premium machines. The increasing deployment of tractors in non-agricultural and commercial haulage applications also demands highly durable drivetrains, further amplifying the need for robust 4WD systems.

The 4WD axle components segment, is Jai Parvati's fastest growing addressable market, is projected to grow at 20-25% CAGR over the same period driven by the increasing sales of 4WD tractors in India.

Growth Drivers

Rising Penetration of 4WD Tractors

Increasing farmer preference for four-wheel-drive models due to superior traction, reduced wheel slippage, and better performance in challenging terrains directly drives the demand for specialized front axle components.

Increasing Farm Mechanization and Labor Shortages

The growing scarcity of agricultural labor is accelerating the adoption of advanced machinery. This structural shift necessitates highly efficient, heavy-duty 4WD tractors to maintain and enhance farm productivity.

Shift Towards Higher Horsepower Tractors

The market is witnessing a steady transition toward higher horsepower tractors to improve crop yields per hectare. These powerful machines require robust 4WD axle configurations to effectively transfer increased engine torque to the ground without causing soil compaction.

Adoption of Heavy Agricultural Implements

The rising use of heavy, modern attachments such as rotary tillers, laser levelers, and front-end loaders requires enhanced front-end stability, load-bearing capacity, and pulling power that only forged 4WD axle parts can provide.

Expansion in Non-Agricultural Applications

The increased deployment of tractors in commercial haulage, construction, and rural infrastructure projects demands highly durable drivetrains, further boosting the requirement for high-strength forged axle components.

Favorable Government Initiatives and Rural Financing

Government subsidies promoting farm mechanization, coupled with improved access to rural credit and financing options, are empowering farmers to upgrade from traditional 2WD models to premium 4WD tractors.

Entry Barriers

High capital investment

Manufacturing 4WD axle components requires investment in forging or casting facilities, CNC and gear cutting machines, heat treatment equipment, grinding and finishing machines, inspection equipment, material handling systems and associated infrastructure. The capital-intensive nature of these facilities may restrict the entry of manufacturers without adequate financial resources.

Technical and metallurgical expertise

Components such as ring gears, kingpins, wheel shafts, mainshafts and wheel carrier hubs are subjected to high torque, impact, bending and wear during operation. Their manufacture requires expertise in material selection, forging or casting, precision machining, gear and spline generation, heat treatment and surface finishing.

Stringent quality requirements

4WD axle components are performance-critical parts that affect power transmission, steering, load carrying capacity and vehicle reliability. Manufacturers must maintain quality control across material procurement, forging or casting, machining, heat treatment, finishing and final inspection. Established suppliers typically employ in-process and final inspection systems to ensure conformity with customer specifications.

Customer approval and product validation

Entry into the original equipment manufacturer supply chain generally involves supplier assessment, prototype submission, product testing, process audits and production validation. Obtaining customer approval may require significant time and expenditure, particularly where the component is developed for a specific tractor platform.

Long customer qualification cycles

Original equipment manufacturers generally evaluate suppliers on parameters such as product quality, manufacturing capability, consistency, delivery performance, cost competitiveness and financial stability. The qualification and commercialisation process may extend over multiple stages, thereby delaying the generation of revenue from new customer programmes.

Established relationships with original equipment manufacturers

Existing suppliers may benefit from long-standing relationships, approved vendor status, knowledge of customer-specific requirements and an established delivery record. These relationships may make it difficult for new manufacturers to secure supply contracts unless they demonstrate improvements in quality, cost, technology or delivery capabilities.

Tooling and development costs

The manufacturers of different components and variants requires dedicated dies, patterns, cutting tools, jigs, fixtures, gauges and inspection arrangements. The initial cost of developing such tooling may be significant and is generally recoverable only after production reaches an adequate scale.

Skilled workforce requirements

The manufacturing process requires experienced personnel in areas such as tool design, metallurgy, forging, casting, CNC machining, gear cutting, heat treatment, quality assurance and maintenance. Recruiting and retaining suitably trained personnel may constitute an entry barrier, particularly for manufacturers seeking to produce high-precision and safety-critical components.

Module IX: Company Overview and Competitive Landscape of key players

JAI PARVATI FORGE LIMITED

Company Overview

Jai Parvati Forge Limited, incorporated in the year 2004, is a Punjab-based manufacturer of forged and high precision-machined automotive and industrial components. Jai Parvati Forge Limited is an unlisted public limited company.

Jai Parvati Forge Limited holds IATF: 16949: 2016 and ISO 9001:2015 certification and has established itself as integrated manufacturer of forged and complex precision-machined components with over 22 years of operating history. The Company manufactures components involving complex geometries, tight dimensional tolerances, stringent surface-finish requirements and multiple manufacturing operations, supported by its integrated capabilities across design and engineering, die manufacturing, forging, heat treatment, gear manufacturing, precision machining and finishing. It supplies transmission, driveline, axle and hydraulic components in the 1 kg to 70 kg range to OEMs across the tractor, commercial vehicle, off-highway and industrial segments.

The company operates four manufacturing units with in-house capabilities spanning forging, heat treatment and precision machining across 300+ machines, positioning it as a single point of supply for its OEM customers.

In fiscal 2026, Jai Parvati Forge Limited recorded the highest revenue growth (21.42%), the highest return on equity (22.29%), the highest return on capital employed (20.18%) and the highest asset turnover (1.87x) among the key players profiled in this report.

Over the last 3 years (FY24-FY 26), the company recorded the highest revenue growth CAGR amongst the key profiled peers

Key Products Manufactured

Jai Parvati Forge Limited manufactures over 800 active forged and machined component types, serving multiple end-use industries. The company has over 22 years of manufacturing experience. The product portfolio is as follows:

Table 10: Products Offered

Segment	Components / Products	Application & Technical Description	Raw Material	Gear Quality	Key Finishing Processes	Size Range (mm)	Weight Range (kg)
Bull Gears	- Induction Hardened Bull Gears (spur and helical) - Carburized Spur & Helical Bull Gears	External gears form part of the final reduction power drive of tractors and harvester combines; output is transferred to the rear wheels.	Low carbon alloy steel (carburized versions); medium carbon alloy steel (induction hardened versions)	DIN 8 – DIN 10	Gear shaving	Diameter: 200 – 500 Length: 30 – 150	10 – 65

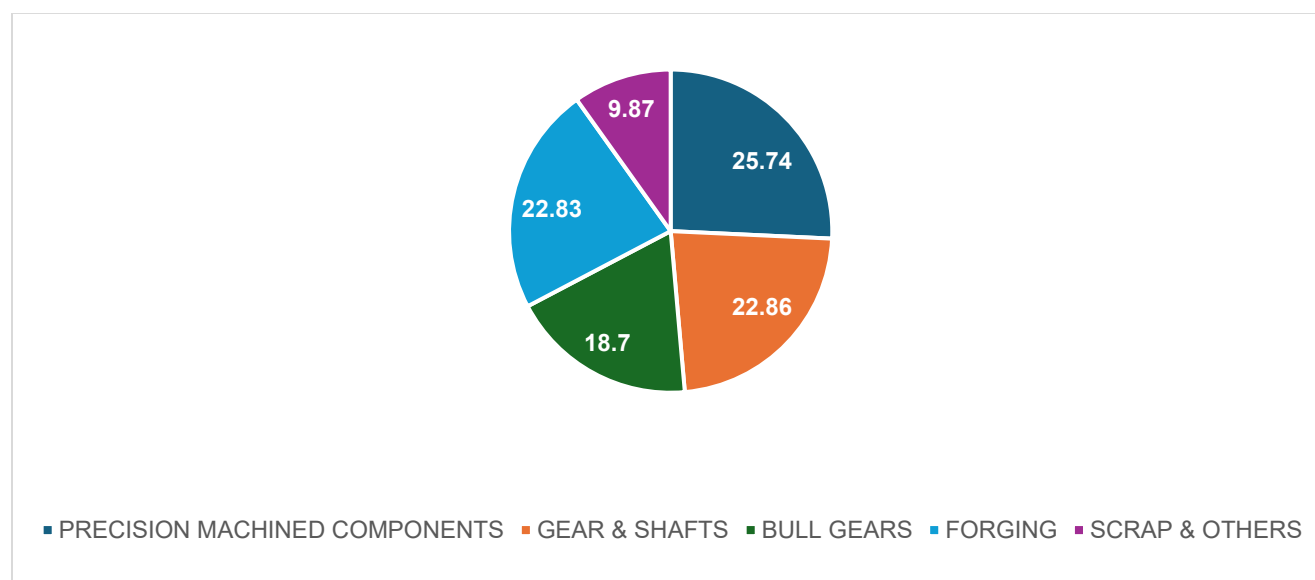
Transmission Gears & Shafts	- Bull Pinion Shafts, Hollow Shafts, Main Shafts - Drive Shaft, Input Shaft, Lay Shaft, Intermediate Shaft, Counter Shaft - Output Flange - Helical Gear, Double Spur Gear, Helical Double Gear	Gears, geared shafts and spline shafts used in power transfer — from engine to gearbox and onward to the final drive — in tractors, commercial vehicles, earth moving equipment and construction machinery, with torque and power varied by gear set engagement.	Low carbon alloy steel (carburized versions); medium carbon alloy steel (induction hardened versions)	DIN 6 – DIN 9	Gear shaving; gear teeth grinding	Diameter: 40 – 250 Length: 450 - 700	2 – 20
Planetary Reduction Parts	- Torque Hubs, Ring Gear Carriers - Ring Gears (plain and induction hardened) - Hub Gears, Planetary Rings - Planet Carrier Assemblies, Planet Gears, Sun Shafts - Clutch Bell Housings, Ring Gear Supports, Hubs	External planet gears, internal ring gears, splined flanges, and geared/splined shafts forming part of the final reduction power drive of tractors, harvester combines, earth moving equipment and construction machinery; output is transferred to the rear wheels.	Low carbon alloy steel (carburized versions); medium carbon alloy steel (induction hardened versions)	DIN 6 – DIN 10	Spline hobbing; gear shaving; gear teeth grinding; power skiving	Diameter: 40 – 450 Length: 20 – 100	2 – 25
Axle & Chassis Components	- Relay Drop Arms, Bell Crank Lever Assemblies - Steering Levers, Equalizer Rod Assemblies	Profile forged and machined parts used in tractor steering linkages, front axle motion amplification, and commercial vehicle suspension linkages. Most parts	Medium carbon alloy steel, hardened and tempered, with localised induction hardening	-	Profile forging; machining; broaching (internal splines); localised induction hardening;	Length: 100 – 400 Thickness : 15 – 50 Width: 30 – 100	3 – 20

	• Front Axle Hub Assemblies , Front Axle Spindle Assemblies • Front Axle Steering Knuckles, Front Axle Steering Arms • Front Axle Spindles, Axle Spindles, EBW Spindles	carry internal splines machined by broaching and are supplied with primer paint.			primer painting		
Hydraulic Parts	• Lift Arms • Rocker Arms • Response Valves Bodies	Profile forged and machined parts used in tractor hydraulic lifts for power-lifting agricultural implements. Most parts carry internal splines machined by broaching and are supplied with primer paint.	Medium carbon alloy steel, hardened and tempered, with localised induction hardening	-	Profile forging; machining; broaching (internal splines); localised induction hardening; primer painting	Length: 100 – 400 Thickness : 15 – 50 Width: 30 – 100	3 – 20
Precision Machined Parts	• Engine and Transmission Gear Blanks • Engine and Transmission on Shaft Blanks • Differential Crown and Pinion Blanks • Bearing Race Blanks	These are used for manufacturing transmission gears, transmission shafts, bearings, Differential Spiral Bevel Crown and Pinions. These are parts processed from forgings and have CNC Turning, VTL, VMC, HMC Operations and Grinding Operations	Low Carbon Alloy Steel Normalised/ Iso Annealed and Medium carbon alloy steel, hardened and tempered	-	CNC Turning, VTL, HMC, VMC and Grinding	Length: 100 – 500 Thickness : 15 – 100 Width: 30 – 100	3 – 50

Source: Company website - Products page and company provided information

The product set is heavily oriented towards tractor/farm equipment transmission and driveline systems, with a secondary focus on commercial vehicle chassis and gearbox components, off-highway planetary drive systems, and industrial applications.

Segment wise revenue details



The company intends to increase the contribution of high value-added precision-machined and precision-engineered products within its overall product portfolio. Its strategy is focused on enhancing the share of products involving higher levels of machining, finishing and engineering complexity, which generally command improved realizations and support margin enhancement

Manufacturing Footprint

Jai Parvati Forge operates an integrated manufacturing network comprising three manufacturing units in Dera Bassi, Punjab, and one unit in Baddi (Dist. Solan), Himachal Pradesh. The company's manufacturing capabilities encompass both forging and precision machining operations.

Its forging infrastructure includes automated press lines and air-operated hammers equipped with three-way temperature-controlled pyrometer-sensed induction billet heaters. The forging lines are capable of producing components ranging from 1 kg to 70 kg and are designed to manufacture parts of varying complexities. The company's machine shop is equipped with more than 300 machines supporting a wide range of precision machining operations, including CNC turning, vertical and horizontal machining, drilling, broaching, grinding, honing, balancing, washing, assembly, leak testing and marking. This integrated setup enables the company to undertake both forging and value-added machining under one manufacturing ecosystem.

High-capacity utilization across units (70-100% in FY26) demonstrating demand visibility. Additionally, acquisition of DS Engineers (Unit-IV) added machining capacity of ~8.6 lakh components p.a.

Table 11: Manufacturing Plants

Parameters	Detail
Location	3 units in Dera Bassi, Punjab; 1 Unit in Baddi (Dist. Solan), Himachal Pradesh.
No. of Plants	4

Units	Particulars	Gross Capacity	Installed Capacity (as on April 1, 2026)	Capacity Utilization (as on March 31, 2026)
Unit-I	Forging	15900 (metric tonnes)	15900 (metric tonnes)	70%
	Precision Machined Components	932700 (numbers)	932700 (numbers)	83%
Unit-II	Bull Gears	418080 (numbers)	418080 (numbers)	94%
	Gears and Shafts	806832 (numbers)	806832 (numbers)	87%
	Precision Machined Components	240240 (numbers)	240240 (numbers)	110%
Unit-III	Forging	16200 (metric tonnes)	16200 (metric tonnes)	87%
Unit-IV*	Precision Machined Components	862800 (numbers)	862800 (numbers)	95%

Note: Jai Parvati Forge has acquired DS Engineers with effect from April 01, 2026, which is currently being operated as Unit-IV

Source: Company website; Company Brochure (2025)

End-User Industries & Customers Served

Table 12: Sectors Covered & Key Customers

Sector	Key Products Supplied	Notable Customers
Agriculture Equipment & Tractors	Bull gears, transmission gears & shafts, drive spindles, ring gears, planetary gears & carriers, flanges & couplings, steering knuckles & arms, lift arms	Mahindra (serving for more than 20 years), International Tractor Limited (Sonalika) (serving for more than 20 years), Siap SPA, Export (serving for more than 3 years), Escorts Kubota Ltd (serving for more than 15 years), Swaraj, TAFE (serving for more than 3 years), Tafe Motors & Tractors (serving

		for more than 3 years), CNH Industrial (serving for more than 12 years)
Commercial Vehicles	Gearbox parts for power transmission, chassis levers, bell crank housings & equalizer bar assemblies, ring gears & planetary gears	Ashok Leyland (serving for more than 15 years), Mahindra (serving for more than 10 years), TATA (serving for more than 5 years)
Off-Highway Vehicles	Gears for construction equipment and mining, complete planetary gear sets, final drives	Action Construction (serving for more than 3 years), Graziano Transmission India Pvt Ltd (Dana Group) (serving for more than 15 years), Carraro (serving for more than 15 years)
Industrial Application	Planetary drives, drive spindles, housings & gears	Dana, PMP, Bonfiglioli Transmission (serving for more than 2 years), Aerostar Group

Source: CRISIL Rating Rationale - JPFL (2025); Company website

Tractor powertrain electrification is projected to remain below approximately 1% penetration through fiscal 2031. Jai Parvati Forge Limited's concentration in tractor and off-highway driveline, reduction-drive, hydraulic and axle components therefore insulate its core demand base from the EV-driven content displacement faced by forging suppliers indexed to PV, CV, 2W and 3W vehicle segments.

Concurrently, the company has secured orders and even started supplying components with end-use applications in electric vehicles, renewable sector and power-generation systems, positioning it to participate in emerging EV driveline demand (rotor shafts, reduction gears, pinions and differential components) as it scales.

The Company has commenced manufacturing helical pinions, planetary ring gears, driven helical gears, planetary pinions and planetary sun gears for use in electric vehicle applications, with a focus on catering to global OEMs. This product portfolio is expected to expand the Company's presence in the global EV components market.

The Company supplies to all leading domestic tractor OEMs- Mahindra, TAFE, Escorts Kubota, Sonalika and Swaraj, alongside commercial-vehicle majors Ashok Leyland and Tata Motors and global Tier-1 suppliers including Dana (Graziano), Carraro and CNH Industrial, with relationship tenures exceeding 20 years with Mahindra and International Tractors Limited

The Company's customer relationships are underpinned by the extended OEM validation cycles and switching costs associated with safety-critical driveline components. Its IATF 16949-certified, forge-to-finished-component manufacturing model integrates forging, heat treatment and precision machining across more than 300 machines, enabling greater control over quality, process consistency and delivery timelines

With capacity utilization ranging from 70% to 100% across its manufacturing units, compared with the forging industry average of approximately 60%, the Company is positioned as a single-point supplier capable of addressing the integrated sourcing requirements of global OEMs, particularly as they increasingly seek to diversify their supply chains through China Plus One sourcing strategies in India

The Company's core addressable markets- transmission gears and shafts (Rs 46 billion), tractor reduction drives (Rs 11 billion), hydraulic components (Rs 4 billion) and 4WD axle components (Rs 3 billion) aggregated about Rs 64 billion in fiscal 2026 and are projected to reach Rs 103-110 billion by fiscal 2031, a CAGR of 10-12%, roughly twice the growth rate of underlying vehicle production, driven by rising content, material costs, complexity and machining value-addition per vehicle.

BHARAT FORGE LIMITED

Company Overview

Bharat Forge Limited, the flagship company of the Kalyani Group and incorporated in 1961 and headquartered in Mundhwa, Pune, Maharashtra, is a global leader in high-performance, safety-critical forged and machined components and engineering solutions. The company serves a broad cross-section of industries spanning automotive, aerospace, defence, oil & gas, railways, marine, construction & mining, and renewable energy. Over its six-decade operating history, Bharat Forge Limited has evolved from a domestic auto-component supplier into a diversified global engineering conglomerate, with manufacturing assets spanning five countries across three continents.

Bharat Forge Limited, Pune is recognized as the world's largest single-location forging facility and is India's largest exporter of auto components. The company operates on a Full Service Supplier model, offering integrated forging, machining, heat treatment, and testing capabilities to global OEMs.

HAPPY FORGINGS LIMITED

Company Overview

Happy Forgings Limited, incorporated in July 1979 and headquartered in Ludhiana, Punjab, is an Indian manufacturer of heavy forged and high-precision machined components. The company is the 2nd largest producer of commercial vehicle and high horsepower industrial crankshafts in India, and the 4th largest engineering-led manufacturer of complex, safety-critical heavy forged and high-precision machined components in the country.

Happy Forgings Limited operates on a vertically integrated model encompassing in-house die design, forging, heat treatment, machining, and quality inspection.

RACL GEARTECH LIMITED

Company Overview

RACL Geartech Limited (RACL), incorporated in 1983 under its original name Raunaq Automotive Components Limited and renamed RACL Geartech Limited in October 2015, is a precision auto-component manufacturer and exporter headquartered in Noida, Uttar Pradesh, with its registered office in New Delhi. RACL is listed on both the NSE and BSE.

The company specialises in high-precision automotive transmission gears and shafts, sub-assemblies, precision-machined parts, chassis components, and industrial gears. RACL operates as a Tier-1 supplier to a select group of marquee global OEMs across the premium motorcycle, passenger car, recreational vehicle, agricultural machinery, and commercial vehicle segments.

RAMKRISHNA FORGINGS LIMITED

Ramkrishna Forgings Limited (RKFL) is a public limited company headquartered Kolkata, West Bengal, India. Incorporated in November 1981, the company has established itself as a prominent player in the metal forming industry over more than four decades of operations.

RKFL is engaged in the manufacturing of forged, machined, and fabricated components serving a diversified customer base across industries such as automotive, railways, farm equipment, earthmoving, mining and construction, oil and gas, power, and general engineering. The company operates as an integrated forging manufacturer with capabilities spanning metallurgy optimisation, product design, tool manufacturing, forging, heat treatment, machining, and fabrication, enabling it to provide end-to-end solutions to its customers.

The company positions itself as one of India's leading integrated forging manufacturers and has developed a global presence through its supply of engineered components to domestic and international markets. Its broad manufacturing capabilities and diversified end-user exposure support its role as a key supplier to multiple industrial sectors.

M M FORGINGS LIMITED (MMFL)

Company Overview

M M Forgings Limited (MMFL), incorporated in 1946 as 'Madras Motors Limited' and listed on both the NSE and BSE, is one of India's oldest and most export-oriented manufacturers of closed-die hot steel forgings. The company transitioned from trading in Royal Enfield motorcycles to forging in 1974 when it established its first forge shop at Singampunari, Tamil Nadu. It was renamed M M Forgings Limited in April 1993 to reflect its manufacturing focus.

MMFL is one of the largest forging company in India with installed capacity of over 1,45,000 Tons. The company is headquartered at Chennai, Tamil Nadu.

MMFL is recognized as the largest exporter of steel forgings from South India, having received the EEPC (Engineering Export Promotion Council) award for Export Excellence for 31 consecutive years. All their facilities are certified to IATF 16949 and ISO 9001 standards.

COMPARATIVE SUMMARY - OPERATIONAL PROFILE

The following table provides a structured side-by-side comparison of all six companies across key operational dimensions.

Table 20: Comparative Summary

Parameters	Bharat Forge Ltd.	Happy Forgings Ltd.	RACL Geartech Ltd.	Jai Parvati Forge Ltd.	Ramkrishna Forgings Ltd.	MM Forgings Ltd.
Year of Incorporation	1961	1979	1983	2004	1981	1946
Headquarters	Pune, Maharashtra	Ludhiana, Punjab	Noida, Uttar Pradesh	Dera Bassi, Punjab	Kolkata, West Bengal	Guindy, Chennai, Tamil Nadu
Core Products	Forged & machined components (steel, Al); castings; defence systems; aerospace forgings	Heavy forged & machined CV/tractor components: crankshafts, front axle carriers, knuckles, differential housings	Precision transmission gears & shafts, sub-assemblies, chassis components, industrial gears; 1600+ SKUs	Bull gears, transmission gears/shafts, planetary reduction parts, front axle spindle assemblies, chassis levers, hydraulic parts; Precision Machined Parts; 800+ SKUs;	Commercial Vehicle components Front-axle, engine, transmission and rear-axle forgings; Light vehicle components including aluminium forgings; 2W crankshafts; farm-equipment crankshafts, gears and axle shafts; railway	Closed-die hot steel forgings (raw, semi-machined, fully machined): front axle beams, knuckles, crankshafts, hubs, High Pressure Valve bodies.

					bogie frames, bolsters, screw couplings and hangers	
Manufacturing Locations	18 plants across 5 countries: India (11), North America (2), Europe (5)	3 plants, Ludhiana, Punjab (Kanganwal I, II; Dugri)	2 plants: Noida & Gajraula (UP); 3 European warehouses; 1 Austrian subsidiary	3 units in Dera Bassi, Punjab; 1 Unit in Baddi (Dist. Solan), Himachal Pradesh	18 plants across Jharkhand, West Bengal and Haryana 1 plant in Mexico	8 plants: Singampunari, Viralimalai, Chennai, Padappai, Ranipet, Pant Nagar (Uttarakhand), Lucknow (UP)
Capacity	7,16,500 TPA (total forging)	1,48,000 MTPA forging capacity; 68,000 MTPA machining capacity	>80,00,000 parts produced per annum	32,100 MT per annum forging capacity; 32,60,652 parts per annum machining capacity*	3,33,400 MT forging capacity; 62,400 casting capacity (16,200 MT to be added in Q1FY27)	1,45,000 Tons
Key End-User Sectors	Commercial Vehicles, Passenger Vehicles, Oil & Gas, Defence, Aerospace, Railways, Marine,	Commercial Vehicles, Farm Equip., Off-Highway, Industrial, Passenger Vehicles	Two-Wheelers, Recreational/ATV, Commercial Vehicles, Passenger Cars, Tractor	Agriculture/Tractors, Commercial Vehicles, Off-Highway Vehicles, Industrial Application	Commercial vehicles, Railways, Mining, Earth Moving & Farm Equipment, Electric Vehicles,	Commercial Vehicles, Passenger Vehicles, Agriculture, Off-Highway Vehicles, High Pressure Valves.

	Construction, Power Generation				Passenger Vehicles, Oil & Gas	
Key Disclosed Customers	Daimler Group, VW Group, Meritor, Dana	SML Isuzu, JCB, Tata Motors, Mahindra Rise, Liebherr, IGW, Bonfiglioli, Hendrickson and Same Deutz-Fahr.	BMW, KTM, ZF, BRP, MAN Trucks, Piaggio, Kubota, TVS, Kawasaki	Mahindra, Ashok Leyland, TATA, Dana (Graziano), Escorts Kubota, Sonalika International, Dana Spicer	-	-

Source: CRISIL Rating Rationale - JPFL (2025); RACL Q4 FY26 Investor Presentation; Happy Forgings Limited Q4 & FY26 Investor Presentation - Sector Mix Slides; Bharat Forge Limited Q4 & FY26 Analyst Update (May 2026); RKFL Investor Presentation Q4FY26; MMFL Annual Report FY26;; Bharat Forge Limited Annual Report 2026; Company website.

*Machining capacity includes Precision Machined Components, Bull Gears, Gears & Shafts

PEER FINANCIAL BENCHMARKING

	Company Name	Units	FY24	FY25	FY26
Revenue from Operations	JPF	INR Millions	3,210.91	3,463.13	4,204.83
	HFL		13,582.36	14,088.95	15,463.36
	RKFL		37,045.45	40,341.07	42,380.77
	RACL		4,095.22	4,150.68	4,899.40
	MMFL		15,630.66	15,251.81	15,898.73

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Revenue Growth YOY	JPF	%	NA	7.86	21.42
	HFL		13.51	3.73	9.76
	RKFL		16.02	8.9	5.06
	RACL		14.32	1.35	18.04
	MMFL		6.92	-2.42	4.24

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Gross Profit	JPF	INR Millions	1,389.00	1,601.47	1,976.75
	HFL		7,616.41	8,172.28	9,145.28
	RKFL		18,429.88	20,345.58	20,760.23
	RACL		2,944.86	2,945.62	3,464.4
	MMFL		8,458.26	8,632.31	8,772.48

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
GP Margin	JPF	%	43.26	46.24	47.01
	HFL		56.08	58.0	59.14
	RKFL		49.75	50.43	48.99
	RACL		71.91	70.97	70.71
	MMFL		54.11	56.6	55.18

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
EBITDA	JPF	INR Millions	489.18	570.33	762.89
	HFL		3,875.37	4,066.98	4,706.89
	RKFL		7,729.12	5,595.55	6427.01
	RACL		958.79	850.19	1069.1
	MMFL		2,928.30	2,960.76	2,799.81

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
EBITDA Margin	JPF	%	15.24	16.47	18.14
	HFL		28.53	28.87	30.44
	RKFL		20.86	13.87	15.16
	RACL		23.41	20.48	21.82
	MMFL		18.73	19.41	17.61

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
PAT	JPF	INR Millions	238.14	258.18	412.17
	HFL		2,429.84	2,674.36	3,016.29
	RKFL		2,828.81	3,315.50	717.97
	RACL		394.01	237.74	489.5
	MMFL		1,350.40	1,218.62	986.66

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
PAT Margin	JPF	%	7.42	7.46	9.80
	HFL		17.89	18.98	19.51
	RKFL		7.64	8.22	1.69
	RACL		9.62	5.73	9.99
	MMFL		8.64	7.99	6.21

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Return on Equity (RoE)	JPF	%	18.84	17.06	22.29
	HFL		18.69	15.45	15.17
	RKFL		14.30	11.69	2.27
	RACL		21.17	11.02	16.91
	MMFL		18.48	14.49	10.56

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Return on Capital Employed (RoCE)	JPF	%	18.79	17.28	20.18
	HFL		21.45	16.97	16.63
	RKFL		16.47	6.75	5.63
	RACL		16.30	10.54	12.86
	MMFL		14.17	11.18	8.67

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Net Working Capital Days	JPF	Days	96	107	102
	HFL		173	213	223
	RKFL		111	105	89
	RACL		176	205	194
	MMFL		128	145	143

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Fixed Asset Turnover	JPF	Times	1.86	1.71	1.87
	HFL		1.56	1.37	1.15
	RKFL		1.40	1.16	1.03
	RACL		1.32	1.27	1.42
	MMFL		1.51	1.13	1.11

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Operating Cash Flows	JPF	INR Millions	348.62	348.11	562.20
	HFL		1,894.39	2,923.32	4,446.68
	RKFL		6,314.59	333.47	8,397.55
	RACL		352.92	563.00	918.50
	MMFL		1,486.67	1,816.21	2,296.87

Source: Company reports, Crisil Intelligence

	Company Name	Units	FY24	FY25	FY26
Debt to Equity	JPF	Times	0.75	0.72	0.60
	HFL		0.09	0.12	0.15
	RKFL		0.42	0.66	0.71
	RACL		1.37	1.35	0.64
	MMFL		1.03	1.18	1.10

Formulas used

1. Revenue from Operations is stated as per the Company Annual reports
2. Growth in Revenue from Operations (%) is calculated as a percentage of Revenue from Operations of the relevant period minus Revenue from Operations of the preceding period, divided by Revenue from Operations of the preceding period as stated in Restated Financial Statement.
3. Gross Profit is calculated as Revenue from Operations less Cost of Materials consumed, Purchases of stock-in-trade and Change in Inventory as stated in Restated Financial Statement.
4. Gross Profit Margin is calculated as Gross Profit calculated as above divided by Revenue from Operations as stated in Restated Financial Statement

5. EBITDA is calculated as Profit before Exceptional items, Inc from JV and tax, plus finance costs and depreciation & amortization expenses reduced by other income as stated in Restated Financial Statement.
6. EBITDA Margin (%) is calculated as EBITDA calculated as above divided by Revenue from Operations.
7. *Profit After Tax is Profit for the period from continuing operations as per company annual reports.*
8. PAT Margin (%) is calculated as PAT mentioned above divided by Revenue from Operations.
9. RoE (Return on Equity) (%) is calculated as Profit after tax from continuing operation for the year divided by Average total equity as stated in Restated Financial Statement.
10. RoCE (Return on Capital Employed) (%) is calculated as earnings before interest and taxes (Profit before extraordinary items and tax plus finance costs minus other income) divided by average capital employed. Capital Employed includes Tangible Net Worth, Long-Term Borrowing (excluding lease liabilities) & Short-Term Borrowing and Deferred Tax Liability/(Asset) as stated in Restated Financial Statement.
11. Net Working Capital Days is calculated as Net working capital as at the end of the year divided by revenue from operations multiplied by number of days in a year. Working Capital is calculated as Current Assets minus Current Liabilities (excluding short term borrowing).
12. Fixed Asset Turnover Ratio is calculated as revenue from operations divided by closing sum of property, plant & equipment, intangible assets, ROU Asset and capital work in progress.
13. *Operating Cash flows are as per Cash flow statements.*
14. Total Debt to Equity Ratio is calculated as total borrowings (i.e. long-term borrowing and short-term borrowing) (excluding lease liabilities) divided total equity less revaluation surplus available to the equity shareholders of the Company as stated in Restated Financial Statement.

Module X: Threats and Challenges of the Gears, Shafts and Precision Components Industry

The Accelerated Transition to Electric Vehicles

The most profound structural threat to traditional automotive forging is the global shift toward electric mobility. Electric vehicles require significantly fewer moving parts compared to internal combustion engine vehicles. Critical forged components such as crankshafts, camshafts, connecting rods, and traditional transmission gears are eliminated in battery-electric architectures. While there remains a need for forged chassis, suspension, and steering components, the net reduction in forging content per vehicle threatens to create severe overcapacity and revenue contraction for manufacturers heavily indexed to powertrain components.

Raw Material and Energy Price Volatility

Forging is a highly energy and material-intensive process. Manufacturers are highly exposed to the price volatility of primary inputs, particularly steel, aluminum, and specialized alloys. Furthermore, the forging process requires substantial energy consumption for heating and heavy machinery operation. Geopolitical tensions, trade tariffs, and global supply chain bottlenecks frequently lead to input cost inflation, which manufacturers often struggle to pass on to original equipment manufacturers in a timely manner, resulting in margin compression.

Material Substitution and the Lightweighting Trend

To meet stringent fuel efficiency and electric vehicle range requirements, OEMs are aggressively pursuing vehicle lightweighting. This trend poses a direct threat to traditional steel forgings. There is an increasing substitution effect as automakers pivot toward lighter materials, such as high-strength aluminum, magnesium, and advanced carbon composites. Additionally, alternative manufacturing processes, such as high-pressure die casting and additive manufacturing, emerge as viable, cost-effective alternatives to traditional forging for complex parts.

Stringent Environmental and Sustainability Regulations

The forging industry is traditionally carbon intensive. As global regulatory bodies enforce stricter greenhouse gas emission standards and carbon taxes, forging manufacturers face mounting compliance costs. The push for green steel and carbon-neutral manufacturing processes requires substantial capital expenditure to upgrade legacy furnaces and transition to cleaner energy sources. Failure to meet the environmental, social, and governance expectations of major Tier-1 suppliers and OEMs could result in a loss of preferred vendor status.

High Capital Intensity and Technological Obsolescence

The forging industry is highly capital-intensive, requiring massive investments in heavy presses, dies, and automated production lines. The rapid evolution of automotive technology means that product lifecycles are shortening. Manufacturers face the risk of technological obsolescence, where expensive tooling and machinery dedicated to legacy internal combustion engine components become stranded assets. Pivoting

to new product lines requires further capital expenditure, straining free cash flow and increasing leverage risks.

Supply Chain Vulnerabilities and Production Cuts

Forging manufacturers sit mid-stream in the automotive supply chain and are highly sensitive to broader macroeconomic shocks. Disruptions at the OEM level cascades down the supply chain, leading to sudden order cancellations or delayed production schedules. This lack of predictability complicates inventory management and capacity utilization planning.

Skilled Labor Shortages

The industry faces a persistent challenge in attracting and retaining skilled labor. The specialized knowledge required for die design, metallurgy, and heavy machinery operation is becoming scarce as the existing workforce ages. The traditional manufacturing environment often struggles to attract younger talent, necessitating increased investments in automation and robotics to bridge the labor gap.

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