ACMA
Mobility Foundation

65TH ANNUAL SESSION

NAVIGATING GEOPOLITICAL CHALLENGES: CREATING A RESILIENT AUTOMOTIVE SUPPLY CHAIN IN INDIA

COMPENDIUM OF PAPERS

September 12, 2025

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NAVIGATING GEOPOLITICAL CHALLENGES:
CREATING A RESILIENT AUTOMOTIVE
SUPPLY CHAIN IN INDIA

Compendium of Papers

September 12, 2025
Taj Palace, New Delhi

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About ACMA

The Automotive Components Manufacturers Association of India (ACMA), with over 1150 members, is the premier organization representing India's automotive components manufacturing industry.

ACMA's mission is to drive industry growth, job creation, and economic prosperity. Committed to research and development, ACMA ensures that India remains a leader in global automotive components manufacturing.

ACMA supports its members through an expanding network, offering valuable resources, industry insights, and collaboration opportunities. The organization is also instrumental in shaping policies and regulations that foster sustainable and inclusive growth.

India's automotive sector is a vital part of its economy, contributing 49% to the country's manufacturing GDP and 6% to the overall GDP, while supporting over 30 million jobs. The auto industry in the country is valued at over $150 billion.

In FY 2024-25, the auto component industry grew to USD 80.2 billion, reflecting a 9.6% increase from USD 74.1 billion the previous fiscal year. Domestic OEM supply rose by 10 % to USD 67.9 billion, with the electric vehicle (EV) sector contributing 6.7% to total sales to OEMs. Exports increased by 8% to USD 22.9 billion, while imports grew by 7.3% to USD 22.4 billion, resulting in a trade surplus of USD 450 million. The aftermarket sector also expanded by 6% to 11.8 billion.

Auto component exports grew by 8% to USD 22.9 billion in FY 2024-25, with North America accounting for 32% of exports, Europe 29.4%, and Asia 25%. Key export items include drive transmission and steering, engine components, body and chassis, and suspension and braking systems.

Imports of auto components rose by 7.3% to USD 22.4 billion, with Asia contributing 66%, Europe 25%, and North America 7.3%. Key imports included engine components, body and chassis, suspension and braking, and drive transmission and steering systems.

The aftermarket sector, valued at USD 11.8 billion, saw growth due to increased vehicle usage and higher demand for used vehicles. This sector is experiencing greater e-commerce penetration and organization, particularly in rural areas.

ACMA plays a critical role in advancing India's automotive industry by promoting trade, enhancing technology, improving quality, and disseminating information. The association participates in international trade fairs, sends trade delegations abroad, and publishes industry materials.

ACMA also contributes to manufacturing excellence through skills training, mentoring programs, and initiatives like 'Asset Turnover Improvement,' 'Uptime Improvement,' 'Zero Defect Quality,' and 'Sustainable Manufacturing.' It is actively involved in various government panels, committees, and councils to influence policies and regulations.

ACMA has signed Memoranda of Understanding (MoUs) with over 30 counterpart organisations in several countries to facilitate information exchange and trade cooperation.

For more information about the Indian automotive industry, visit ACMA's website: www.acma.in.

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An Update on the Indian Auto Component Industry FY 2024-25

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Automotive Component Manufacturers Association Of India

An Update on the Indian Auto Components Industry

FY 2025



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Indian Auto Component Industry-A key driver of Indian Economy

Industry turnover nearly doubled, growing at a CAGR of 14% from FY20 to FY25.

Industry Turnover

FY 25
6.73 Lakh Crore

FY20
3.49 Lakh Crore

CAGR-14 %

Sales to OEM
5.70 Lakh Crore | 3.02 Lakh Crore
CAGR-13.4%

Exports
1.92 Lakh Crore | 1.02 Lakh Crore
CAGR-13.4%

Aftermarket
0.99 Lakh Crore | 0.69 Lakh Crore
CAGR-7.45 %

Imports
1.88 Lakh Crore | 1.09 Lakh Crore
CAGR-11.4 %

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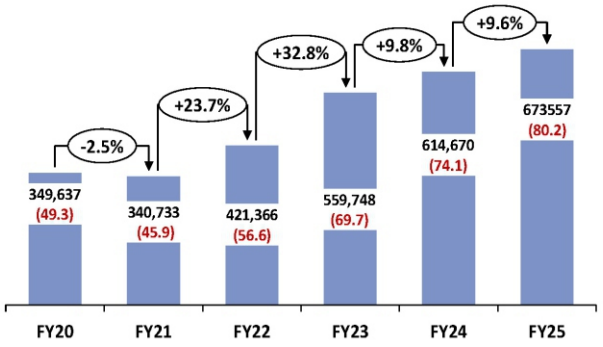
FY 2025: Auto Component Industry Performance

Size of industry[1] | INR Cr (USD Bn)



The auto-components industry grew 9.6% y-o-y on account of increased supply to OEMs, exports and aftermarket

Source: PwC research, CRISIL, SIAM, includes Tractors, Construction Equipment

FY25 – Auto components industry performance

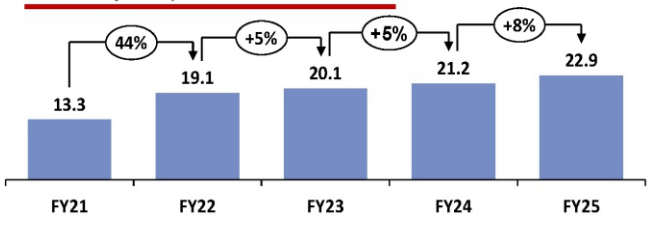
- Auto component industry grew by 9.6%
- Supply to OEMs increased up **10%**, driven by **8% rise in total vehicles production**
- **Trade surplus** widened to **$453 million** (vs $300M in FY24); **exports up 8%, imports up 7.3%**
- **Aftermarket** grew **6%**, supported by a **growing and aging vehicle base**
- **Passenger vehicle production** rose **3.8%**, led by **14% growth in UVs**, now **60% of PV volume** (vs 56% in FY24)
- **Two-wheeler production** grew **9.4%**, with increased output in **higher price segments**
- Supply to EVs accounted for **6.7% of total supply to OEMs**

Notes: 1 - excludes tyres, paints, powder coating, batteries & consumables
2 - EVs include only Li ion battery operated vehicles. Cost of Li ion battery excluded from component consumption calculations
3 - A 4% increase in raw material cost has been incorporated in FY25 calculation to account for inflation
4 – USD/INR rate for FY25 has been considered at 84,based on the average exchange rate data for FY25

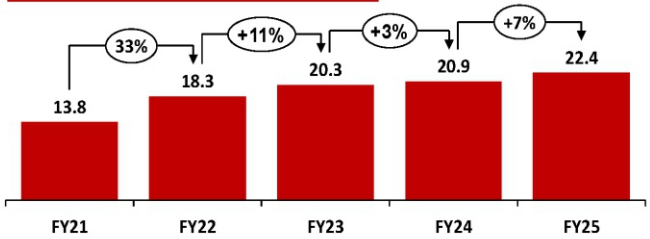
FY 2025: Exports & Imports –Balance of Trade

India had a trade surplus of 453 Million USD for auto components-strong demand for exports

Total Exports | $ Bn.



Total Imports | $ Bn.



Source: CRISIL, Ministry of commerce, PwC research

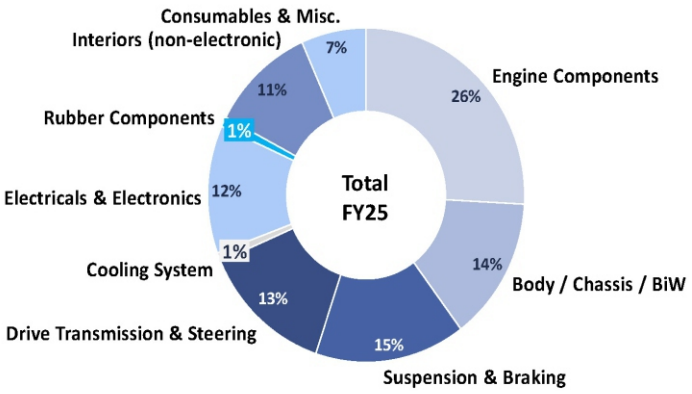
FY25 EXIM performance

- Exports grew by **~8%** and imports by ~7% (vs. FY24)
- The trade surplus stood at $453 million
- **'Engine components'** and **'Drive Transmission and Steering'**, remain the dominant segment, accounting for more than half of exports.
- **'Steering'** and **'Engine'**, remain the two dominant segments in imports, accounting for 57% of the total

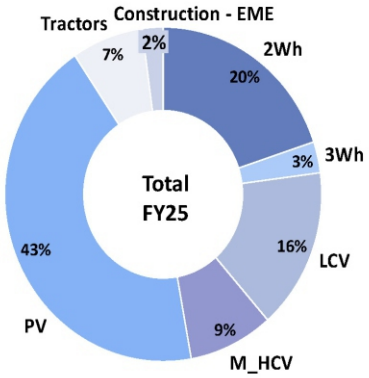
FY 2025 : Sales by Category & Revenue from OEMs

Overall Component Sales By Category:

Includes Sales to OEMs, Aftermarket, and Balance of Trade

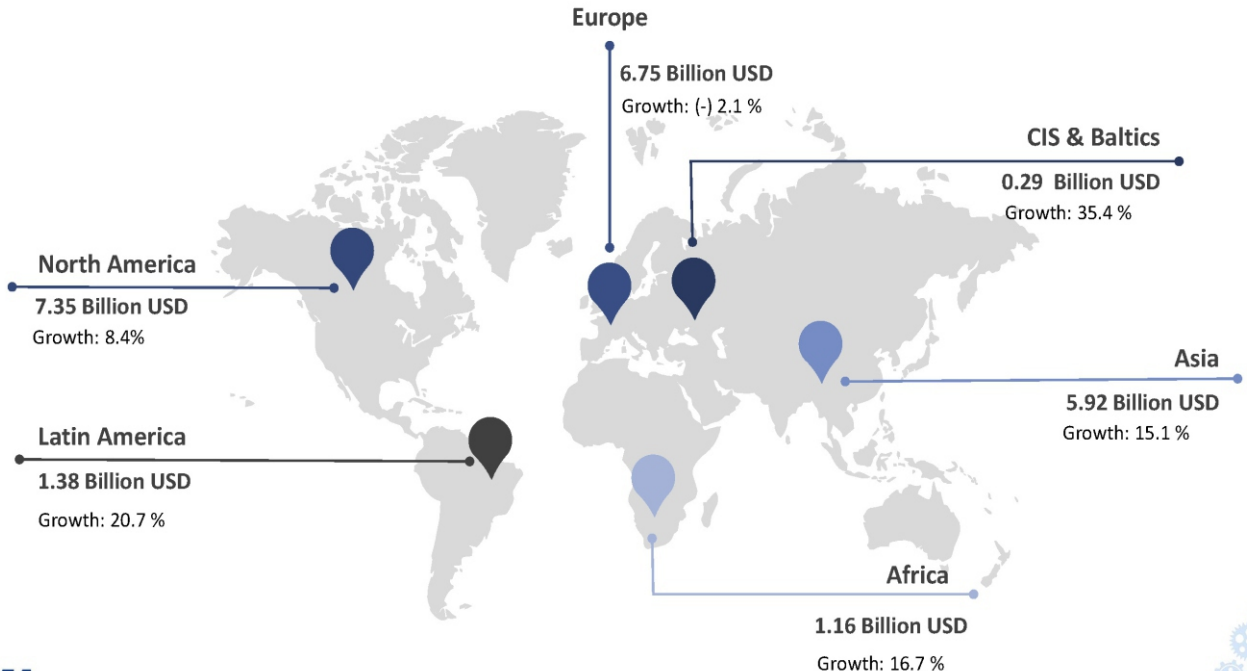


Component Sales to OEMs By Segment:

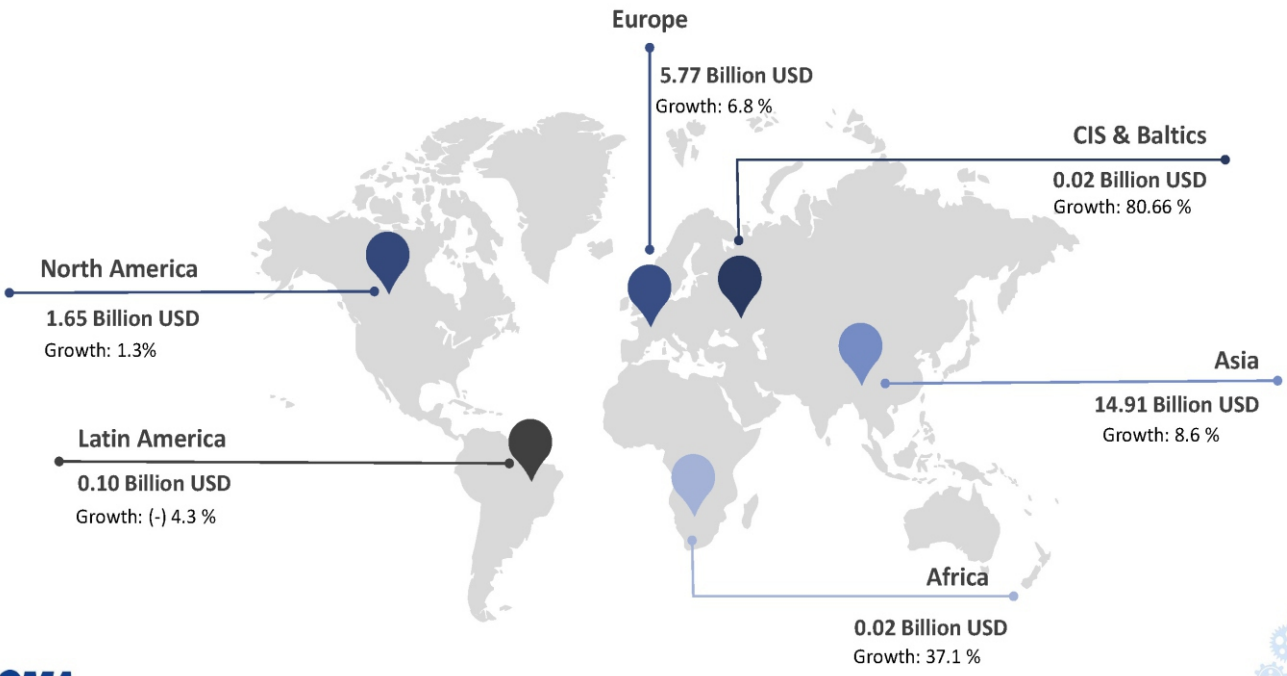


Source: PwC research, CRISIL, SIAM

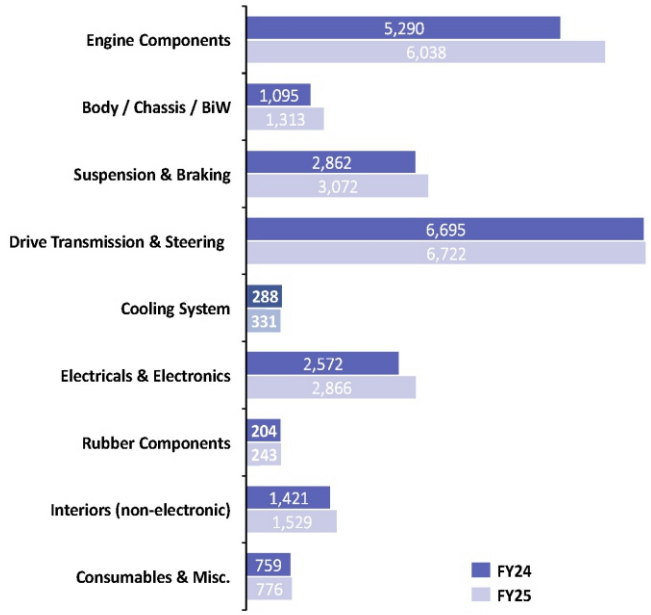
FY 2025: Region wise Exports

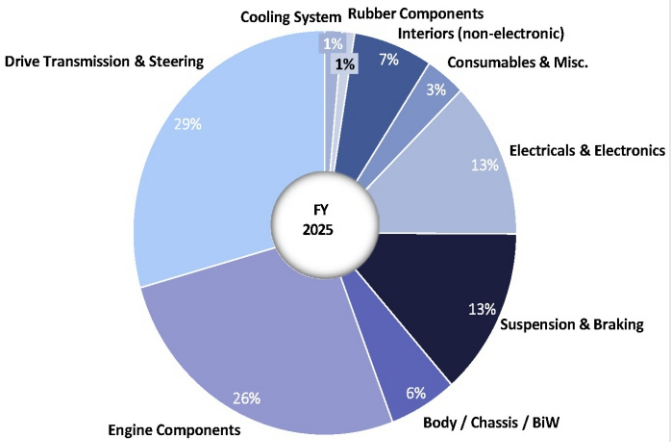


FY 2025: Region wise Imports

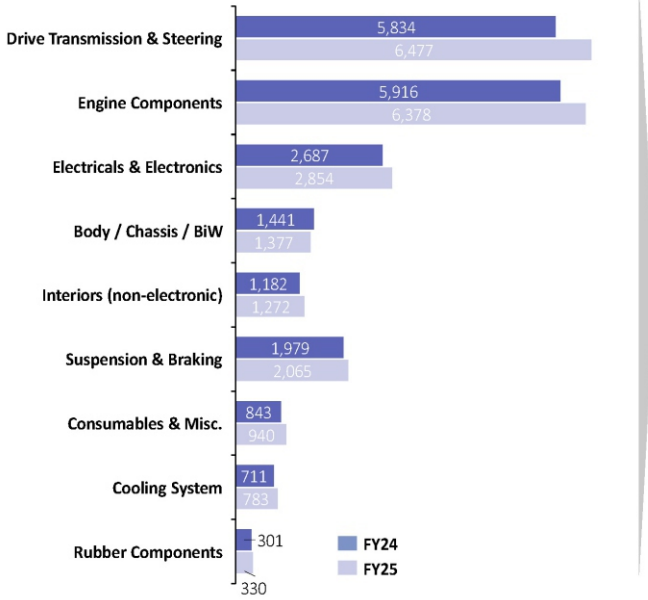


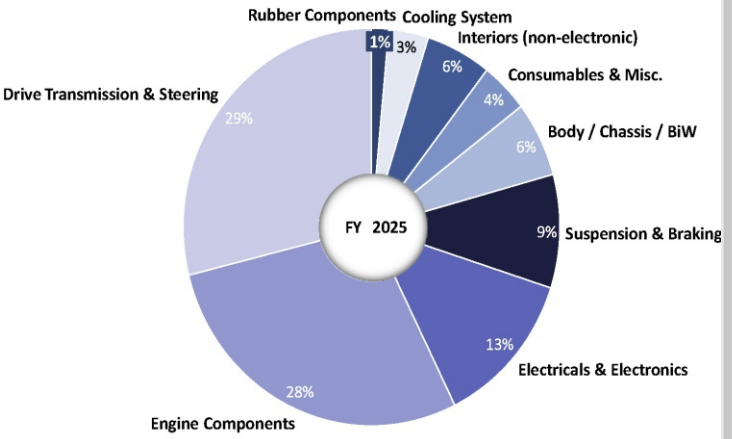
FY 2025: Exports Segmentation by Product Type





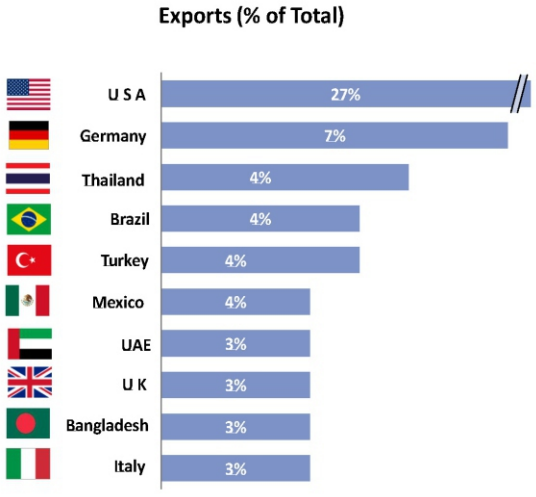
FY 2025: Imports Segmentation by Product Type

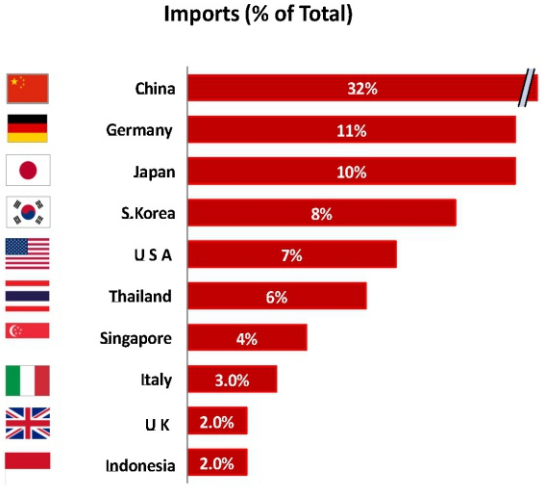




Top 10 Country wise: Imports & Exports

USA key destination for exports while China is key source of imports





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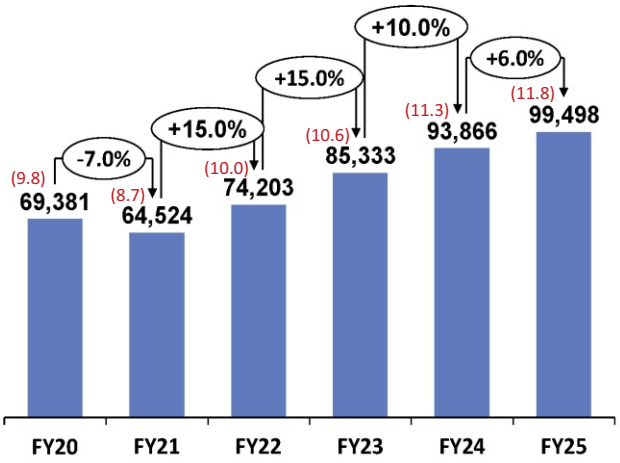
FY 2025 : Indian Auto Component Aftermarket

Aftermarket grew by 6% due to an increase in used vehicle parc, enhanced e-commerce and formalization of the repair and maintenance market

Afermarket | INR Cr (USD Bn)



Source: PwC research, ACMA

FY25 Aftermarket

- The expansion of the automotive aftermarket is propelled by rising vehicle usage for personal and commercial purposes.
- Growth is fueled by rural development in entry-level segments, shifting preferences towards larger vehicles, and the increasing formalization of the repair and maintenance market.
- Premiumization, organized service marketplaces and direct to consumer sales model bolsters the aftermarket segment

Summary: FY 2025 vs FY 2024

Figures in INR Crore	FY 2025	FY 2024	Growth Rate
Auto Components Supply to OEMs	570,145	518,313	10%
Aftermarket	99,498	93,866	6%
Exports	192,326	175,960	9.3%
Imports	188,412	173,470	8.6%
Industry Turnover	**673,557**	**614,670**	**9.6%**

Figures in USD Billion	FY 2025	FY 2024	Growth Rate
Auto Components Supply to OEMs	67.9	62.4	8.7%
Aftermarket	11.8	11.3	4.7%
Exports	22.9	21.2	8.0%
Imports	22.4	20.9	7.3%
Industry Turnover	**80.2**	**74.1**	**8.3%**

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Headwinds and Tailwinds

Tailwinds

- Largely Stable Domestic Demand
- Largely Stable international demand/Exports
- Emphasis on infrastructure development
- Increased Investments and Capacity Expansion
- Govt Focus: Carbon Neutrality
- New entrants in mobility space

Headwinds

- Geo-political challenges
- Increasing Freight Costs
- Challenge of Rare Earth Magnets availability
- Raw Material Price Volatility
- High GST rates on auto components

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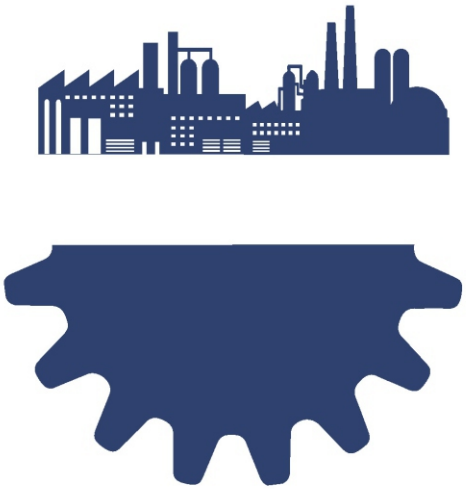

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Current Landscape and Future Prospects of the Indian Automotive Industry

By

Crisil
Intelligence

Crisil Intelligence

Macroeconomic overview

Global economy slowing down

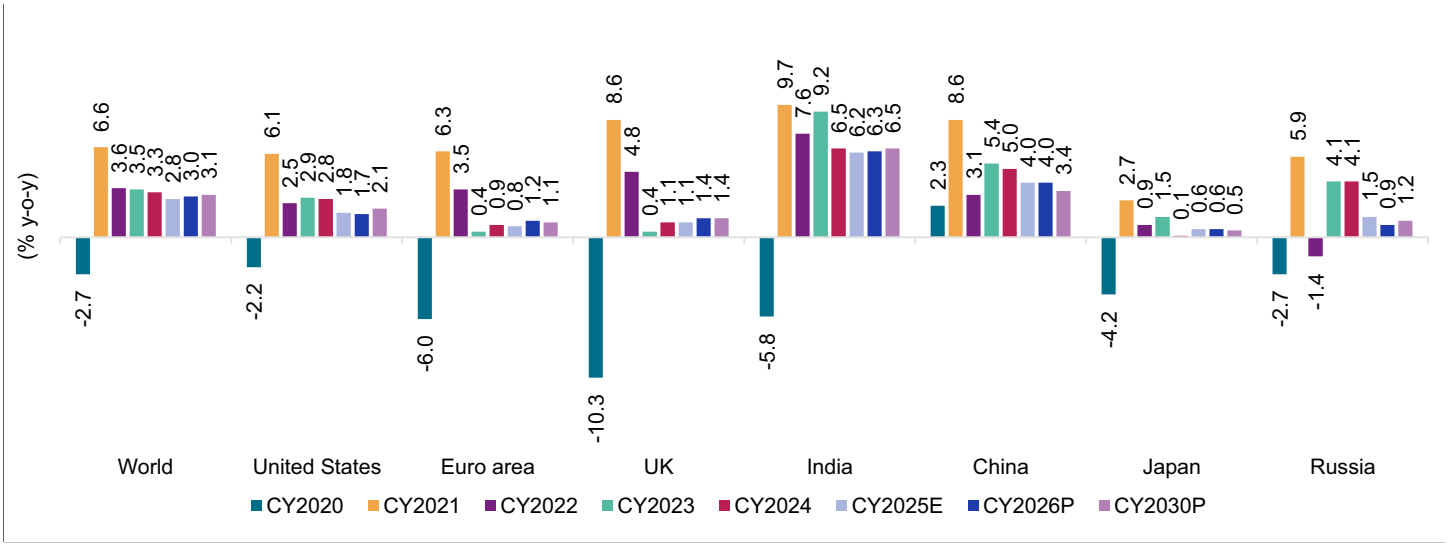
The global economy showed remarkable resilience in calendar year (CY) 2024 despite geopolitical tensions, high interest rates, tightening of financial conditions and the growing intensity of extreme weather events.

This year, however, the additional tariffs imposed by the United States (US) on most countries and the ensuing countermeasures by its trading partners will likely weaken economic growth.

According to the International Monetary Fund (IMF), global growth is projected to drop to 2.8% in 2025 from 3.3% in the previous year.

In advanced economies, growth is projected to slow down because of greater policy uncertainty, trade tensions and softer demand momentum. In emerging markets and developing economies, growth is expected to slow down with significant downgrades for countries affected most by the recent trade measures. India, however, is expected to maintain its 6.5% pace, supported by private consumption, particularly in the hinterland.

Divergent growth trends



P - projected
*Note: On a calendar year basis. *Euro area comprises 19 member countries of the European Union*
Source: IMF, World Economic Outlook (WEO) – April 2025 update, Crisil Intelligence

The IMF expects **US** growth to fall sharply to 1.8% in 2025 (2.8% in 2024) because of greater policy uncertainty, trade tensions and softer demand momentum. In 2026, growth is projected to drop further to 1.7% amid moderate private consumption.

At the same time, **euro area** growth is expected to taper marginally to 0.8% this year due to rising uncertainty amid tariff action. In 2026, a modest pickup is expected on the back of stronger consumption following rising real wages and a projected fiscal easing in Germany. Meanwhile, Spain is expected to log 2.5% growth this year, an upward revision from the IMF's previous estimates. This reflects a large carryover from better-than-expected outrun in 2024 and reconstruction activities following the floods in October last year.

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Japan's gross domestic product (GDP) growth is expected to slow down to 0.6% in 2025, marking a 0.5 percentage point downgrade relative to the IMF's forecast in January. On-year, it is an improvement from 0.1% growth last year, as the tariff announcement-associated uncertainty offset the expected strengthening of private consumption and rise in household disposable income stemming from above-inflation wage growth.

The **UK** is projected to grow 1.1% this year, reflecting a smaller carryover from last year, the impact of tariff announcements, an increase in gilt yields and weaker private consumption amid higher inflation as a result of regulated prices and energy costs.

The growth rate in emerging market and developing economies—China, India, Russia, Brazil, Mexico and South Africa—is expected to decelerate from 4.3% last year to 3.7% this year and 3.9% in the next.

After 5.3% growth in 2024, Asia's growth is expected to taper to 4.5% in 2025 and 4.6% in 2026. The IMF has revised China's growth to 4% this year from 4.6%, reflecting the impact of tariff action, which offset the carryover from 2024 (because of a stronger-than-expected fourth quarter) and fiscal expansion in the budget.

According to the IMF, the growth outlook for India is relatively more stable at 6.2%, supported by private consumption, particularly in rural areas. However, this rate is 0.3% lower than the IMF's previous forecast because of trade tensions and global uncertainty.

Despite slowdown in the near term, India's growth is expected to outperform over the medium run. We expect GDP growth to average 6.7% between fiscals 2025 and 2030, compared with 3.3% globally, as projected by the IMF.

Indian economy cruising

India is the world's fourth-largest economy and the fastest growing among major economies, having clocked 5.3% CAGR between fiscals 2020 and 2025, supported by benign crude oil prices, soft interest rates and low current account deficit (CAD). Government stimuli—implementation of the Goods and Services Tax (GST), Insolvency and Bankruptcy Code, Make in India and financial inclusion initiatives, and gradual opening of sectors such as retail, e-commerce, defence, railways and insurance to foreign direct investments (FDIs)—have played a key role as well.

The GDP print surpassed the forecasts in fiscal 2024, driven by strong government spending and a sharp rise in manufacturing and construction growth. Globally, robust growth in major economies such as the US and China contributed to better export earnings for India.

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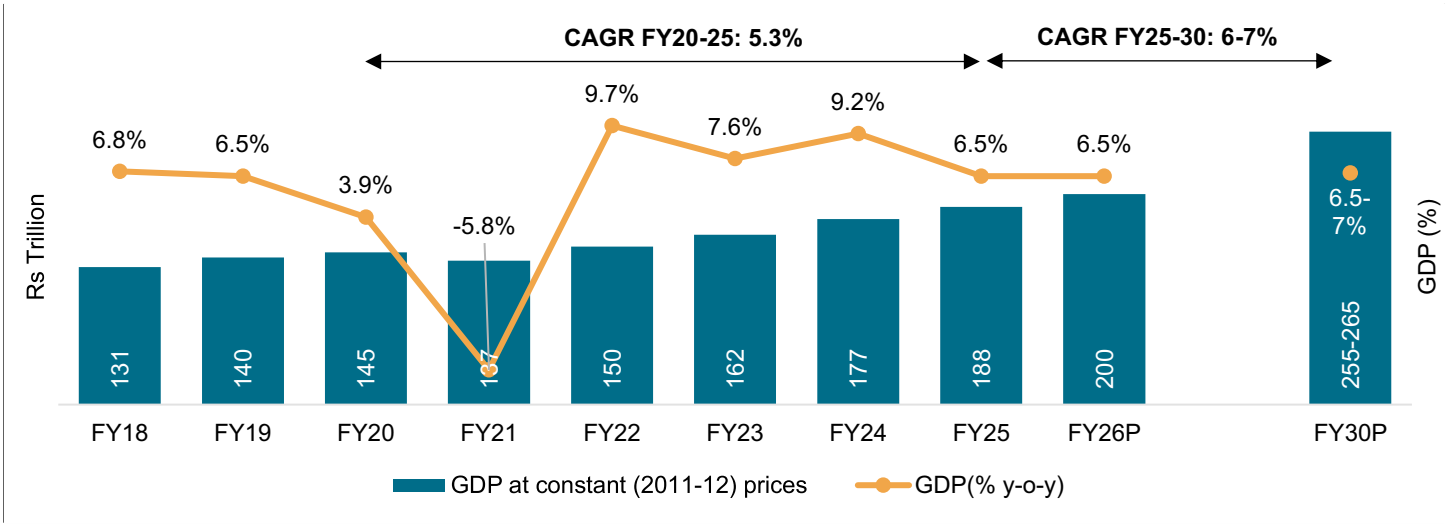
Robust outlook



P – projected
Source: NSO, IMF, Crisil Intelligence

Growth drivers

- Strong domestic demand is expected to drive India's growth in the medium term
- Investment prospects are optimistic, given the government's capital expenditure (capex) push, the progress of the Production Linked Incentive (PLI) scheme, healthier corporate balance sheets and a well-capitalised banking sector with low non-performing assets
- The government's future capex is expected to be supported by tax buoyancy, simplified tax structures with lower rates, reassessment of the tariff structures and digitalisation of the tax filing process
- Medium-term growth is anticipated to be bolstered by increased capex on infrastructure and asset development projects, translating into enhanced growth multipliers

Real GDP growth over fiscals 2025-2030

According to the National Statistics Office's (NSO) second advance estimates, India's real GDP growth is estimated at 6.5% last fiscal, slightly higher than first advance estimates and close to the pre-pandemic average of 6.6% between fiscals 2011 and 2021.

Despite it being lower than 9.2% in fiscal 2024 (the highest in 12 years) and 7.6% in fiscal 2023, India will retain its tag as the fastest growing large economy.

Last fiscal, GDP growth slowed down because of a drop in fixed investment growth to 7.1% from 8.8% in fiscal 2024. However, consumption growth improved to 7.2% from 5.6% and exports growth jumped to 6.3% from 2.2% during the period. In contrast, imports contracted 3.7%.

Real GDP growth was 7.4% on-year in the fourth quarter of last fiscal vs 6.4% in the third quarter but was lower than 8.4% recorded in the year-ago period.

On the demand side, uptick in fourth quarter growth was driven by a substantial pick-up in fixed investments (9.4% vs 5.2% in the third) even as private consumption growth slowed (6.0% vs 8.1% in the third) and government consumption contracted (-1.8% vs +9.3% in the third).

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Growth in exports slowed drastically to 3.9% in the fourth quarter from 10.8% in the third. Imports contracted at a much sharper pace (12.7% vs -2.1%), partially led by a decline in crude oil prices. The slowdown in exports was driven by declining merchandise exports (-4.4% vs +3.0%), hit by global trade tensions, while services exports growth remained resilient (despite some easing). Hence, despite exports decelerating, the continuing fall in imports led to net exports supporting GDP.

This fiscal, too, we[1] expect GDP growth at 6.5%, but with risks on the downside owing to external headwinds such as the US tariff hikes and the ensuing hold on investment and spending decisions by businesses and households. As of now, the pause on tariff increase provides temporary relief, but the 10% universal tariff hike by the Trump administration is in force since April. Slower global growth, along with anticipated reciprocal tariff hikes are likely to hit goods exports this fiscal. Uncertainty regarding tariffs may hinder investments. The eventual impact of these factors will depend on the trade deal India strikes with the US.

Nevertheless, industrial activity will be supported by improving domestic consumption, driven by (1) healthy agricultural growth, (2) easing inflation, supporting discretionary spending, (3) rate cuts by the Monetary Policy Committee (MPC) of the Reserve Bank of India (RBI) and (4) income tax relief.

The India Meteorological Department (IMD) expects an above-normal monsoon this year (at 106% of the long period average), which should lead to a second year of healthy kharif production, continuing to support agricultural income, strengthening rural demand and keeping food prices in check. Furthermore, we expect crude oil prices to remain subdued, averaging $65-70 per barrel this calendar year. Also, bank lending rates have begun easing following the MPC's rate cuts, which should support domestic demand.

The MPC kept the policy rates unchanged during its review meeting on August 6. It maintained its neutral policy stance as well, which implies future monetary policy actions will depend on global developments.

The MPC cut the repo rate by 100 basis points (bps) between February and June. Though there has been sharp reduction in the money market rates, bank lending rates have not eased to the same extent as the repo rate.

The MPC reduced its forecast for the Consumer Price Index (CPI) by 60 bps to 3.1% for this fiscal, prompted by a sharper-than-expected slide in food prices in recent months. However, the MPC expects inflation to rise in the second half of this fiscal and cross 4% by the fourth quarter.

We expect CPI inflation to average 3.5% this fiscal assuming above-normal monsoon and benign global crude oil prices. We maintain India's GDP growth forecast at 6.5%, but with downside risks from tariff actions of the US.

Inflation eases…

India's retail inflation rate has more than halved over the past year, slipping even below the lower end of the RBI's tolerance band of 2%. It slid to 1.6% in July from 2.1% in June. A year ago, it printed at 3.6%. Food saw steeper deflation, while core inflation recorded a sharp decline as the impact of mobile tariff revision wore out.

Food inflation stood at -1.8%, the lowest since January 2019, further down from -1.1% in June. Healthy food production and ample foods stocks have softened the prices.

Core inflation, too, lent support, falling to 3.9% from 4.4%, led by a substantial decrease in transport and communication inflation. Fuel inflation rose to 2.7% from 2.6%.

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[1] *Based on Crisil Centre for Economic Research (CCER) projections*
Projections of key economic indicators for India in this chapter are as per CCER

Crisil Intelligence

Deeper deflation in vegetables and pulses and easing cereal inflation provided significant downward support. According to Crisil Intelligence Thali Index, the cost of vegetarian and non-vegetarian thalis dropped 14% and ~13% on-year, respectively, owing to lower vegetable and broiler prices.

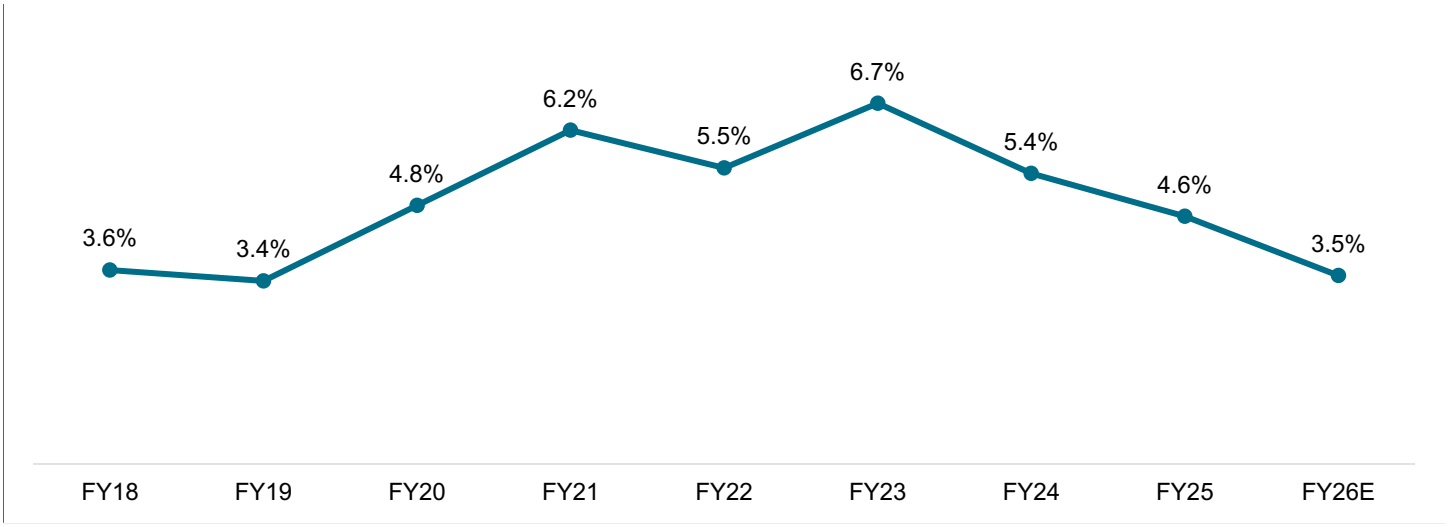
…and is likely to remain benign

We expect headline inflation to average 3.5% this fiscal vs 4.6% last fiscal. Healthy agricultural production is expected to keep food inflation in check.

As on August 8, kharif sowing is up a healthy 4% on-year and adequate soil moisture should benefit the rabi crop as well. Assuming geopolitical uncertainties remain under control, Brent crude oil prices are projected to remain subdued at $60 - 65 per barrel in the current fiscal, which should help contain non-food inflation.

We expect another repo rate cut this fiscal. A cumulative cut of 100 bps so far, along with adequate liquidity, has ensured a swift transmission downstream. The sharp fall in retail inflation should buoy household purchasing power, particularly in the lower income segments. The trend also creates room for further monetary policy easing, which should benefit the interest rate-sensitive consumption segments.

CPI trends down



E - estimated
Source: Ministry of Statistics and Programme Implementation (MoSPI), RBI, Crisil Intelligence

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Review of and outlook on the passenger vehicle industry

The current landscape

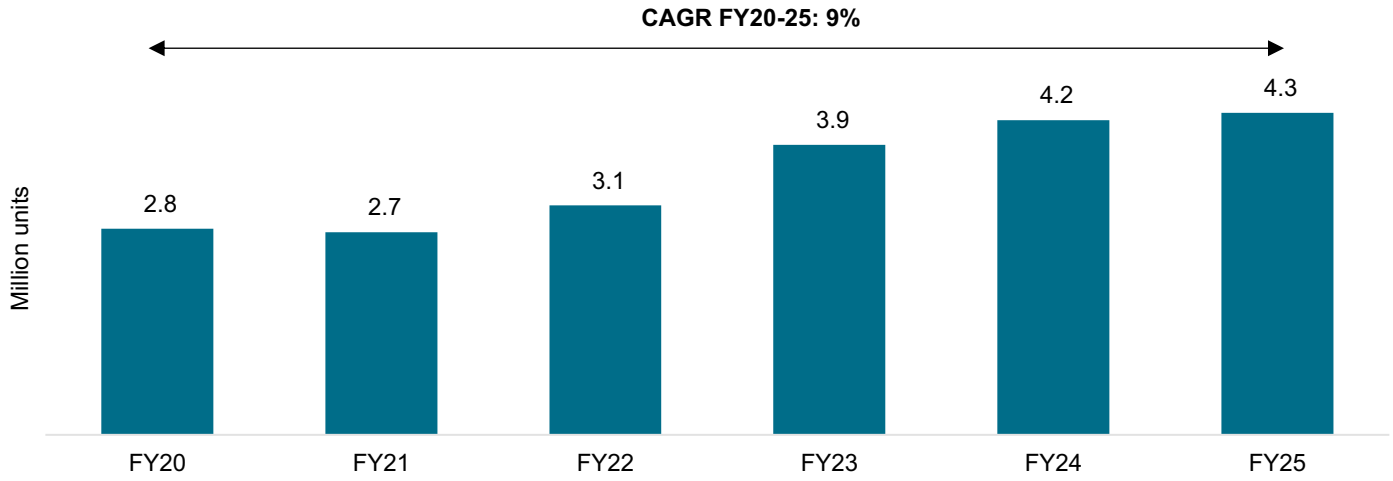
India's domestic PV sales clocked a 9.3% CAGR between fiscals 2020 and 2025, despite a sales contraction (10% CAGR) during fiscals 2019-2021. From the low base of fiscal 2021, PV sales bounced back and grew healthily to reach a historical high of 4.3 million vehicles in fiscal 2025.

In fiscal 2020, the economic contraction driven by the pandemic led to pressure on vehicle sales. Other factors that heightened the pressure include the non-banking financial company (NBFC) liquidity crisis and the halting of BS-IV vehicle production amid the mandatory implementation of BS-VI norms from fiscal 2021. The industry also lost sales in fiscal 2020 owing to the outbreak of Covid-19 and the subsequent nationwide lockdown.

In fiscal 2021, domestic sales continued to be impacted by the first wave of the pandemic. A nationwide lockdown, restrictions on mobility and supply-chain constraints, majorly of semiconductors, led to production cuts, which in turn weighed on annual sales. Despite some improvement in sales following the reopening of the economy and an increase in demand for personal mobility during the second half of the year, sales contracted ~2% year-on-year owing to the price hikes after the implementation of the BS-VI norms.

Fiscal 2022 began with a severe second wave of Covid-19. State-imposed lockdowns, economic uncertainty and a global shortage of semiconductor supply extended waiting periods, impacting sales, especially in the first half of the fiscal. There was some improvement in the economic scenario in the second half, following the reopening of markets. Pent-up vehicle demand, increased use of personal-mobility options driven by fears of infection and an improved supply scenario boosted PV sales by 13% during the period from a low base in fiscal 2021.

Review of domestic PV sales volume



Source: SIAM – The Society of Indian Automobile Manufacturers

In fiscal 2023, the PV industry grew 27% y-o-y, more than double the 13% y-o-y growth witnessed in fiscal 2022. The order books of auto OEMs were further supported by several new launches in the growing SUV category, which saw higher traction. Facelifts of existing models and an easing supply of semiconductors also helped. In fact, the overall wholesale volumes reached a historical high of 3.9 million units in the fiscal.

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Fiscal 2024 marked the third consecutive year of growth (8%) in the PV industry. This growth was achieved over a high base in fiscal 2023. During the year, the order books of auto OEMs were further supported by a plethora of launches in the growing utility vehicles (UV) category, which witnessed high traction, along with multiple facelifts of existing models and easing semiconductor supplies that drove record sales in each quarter of fiscal 2024. The overall wholesale volumes settled at ~4.2 million units in fiscal 2024.

The industry's growth momentum continued in fiscal 2025, albeit at a slower pace, backed by the continued traction for the SUV segment, intermittent launches and an improvement in disposable income. From the high base of fiscal 2024, the industry grew ~2% in fiscal 2025 to hit a record 4.3 million units.

Segmental shifts within the domestic PV industry amidst Premiumisation

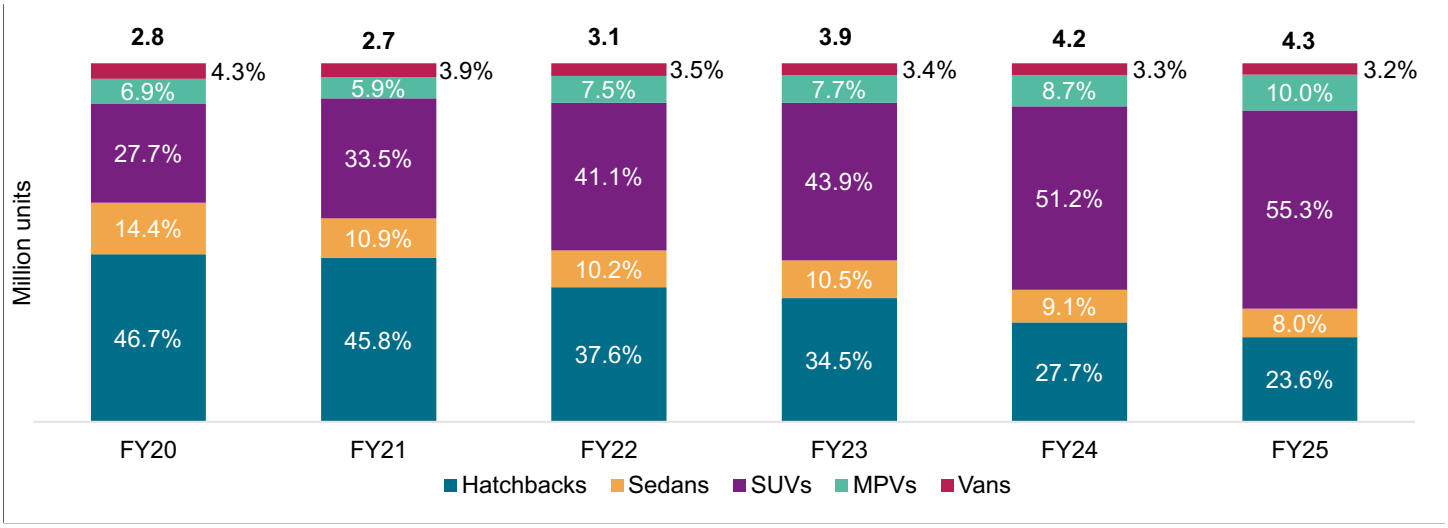
The PV industry can be broadly classified based on body types into hatchbacks, sedans, sports utility vehicles (SUVs), multipurpose vehicles (MPVs) and vans. Traditionally, Indian passenger vehicle buyers have been cost-conscious, with mileage and initial vehicle buying cost being the two main pillars of decision-making. Therefore, the hatchback segment had been leading PV sales over the years, primarily because of the lower ticket size and lower running costs, making it affordable for the average Indian consumer.

However, with a growing share of younger buyers in India, there is an increasing awareness and preference towards parameters other than price, such as exterior and interior design, driving experience, safety, advanced features and aesthetics, resulting in an inter-segmental shift towards SUVs, as well as an intra-segmental shift towards the mid- to top-end variants.

OEMs have addressed this change in preference by showcasing enhanced vehicle safety features in their recent launches. Several OEMs have also gradually introduced advanced features and trickled them down from their top variants to the mid variants. Furthermore, rising disposable incomes have given an impetus to growth in the SUV segment.

Customer buying behaviour is also changing, wherein they are increasingly prioritising vehicle experience and technology over cost, willing to pay a premium and are also ready to wait longer for the desired vehicle. More number of customers are now opting to buy mid- to top-level variants, driving the intra-segmental shift. This shift towards feature-loaded vehicles is also driving the premiumisation trend.

Segmental shifts within the domestic PV industry



Note: The figures above the bars denote sales volume.
Source: SIAM – The Society of Indian Automobile Manufacturers

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Slowdown in hatchbacks

The hatchback segment—once the leading segment—has seen a loss in market share in recent years owing to lack of new-model launches, frequent hikes in vehicle prices, an increase in operating costs amid fuel-price hikes and an unfavourable macroeconomic environment that impacted the price-sensitive entry-level customer base. This caused the share of hatchbacks to contract to 24% by fiscal 2025 from 47% in fiscal 2020. Changing consumer preference towards SUVs, premiumisation and a limited focus by auto OEMs on the hatchbacks segment also impacted the sales of the hatchback segment.

Additionally, acquisition costs rose sharply due to the price hike caused by the implementation of BS-VI emission norms and an increase in raw-material costs. This price rise was over and above the general annual price hike undertaken by OEMs, pushing the prices even higher. Operating costs also shot up amidst a rise in fuel prices. On the other hand, the income levels of this entry-level customer segment were also severely impacted during the pandemic.

Moreover, the rising pre-owned car market emerged as an alternative option for these price-sensitive customers. Increased transparency, improved vehicle quality and a rising share of the organised segment aided the pre-owned vehicle industry, in turn restricting the growth of hatchbacks, especially the compact hatchback segment.

Lower demand for sedans

Sedans are relatively premium vehicles preferred by the upper-middle-class and affluent-class customers, as well as the customers who prefer the compact sub-4-metre sedans such as the Maruti Suzuki Dzire, Hyundai Aura, Hyundai Xcent and Honda Amaze, especially for commercial purposes.

During the last five years, the demand for sedans has dropped at a 3% CAGR. The shift towards the SUV segment, reduced traction for premium sedans and limited launches restricted the sales of sedans during fiscals 2020-2025, while their contribution to the overall PV sales dropped to 8% by fiscal 2025 from 14% in fiscal 2020.

Rise of SUVs

The SUV segment, which traditionally appealed to customers valuing a larger seating capacity and its ability to drive on rough terrains, has increasingly gained customer preference over the years. The compact SUV segment, in particular, provided the much-desired SUV body styling at competitive rates, bringing the SUV segment within the reach of the common consumers.

Recognising the changing consumer preferences, OEMs also launched a higher number of vehicles in the SUV segment compared with the other segments, providing a further fillip to the expansion of the SUV segment.

Thus, the changing customer preference, coupled with new vehicle launches, provided a real thrust to the growth of the SUV segment. Prominent launches from players such as Hyundai Motor India, Tata Motors, Mahindra & Mahindra and Maruti Suzuki aided the growth of this segment. Moreover, the entry of global players such as Kia and MG with their SUV portfolios lent further support to the growth of the segment.

All these factors led to the share of SUVs in the overall domestic PV sales to nearly double to 55% in fiscal 2025 from 28% in fiscal 2020. During the last five years, although the industry witnessed only ~9% CAGR, the SUV segment clocked a 26% CAGR, which is ~3x the industry growth rate.

Sales of MPVs consisting of vehicles such as Toyota Innova and Maruti Suzuki Ertiga, primarily catering to the tourist and office transport segment, were impacted during the pandemic due to reduced mobility. Amidst the gradual reopening of the offices, as well as a rise in tourism, the segment sales rebounded in the following three years. During the entire five-year period, the sales of MPVs increased at a healthy 18% CAGR. The addition of new vehicles such as Toyota Innova

Hycross and Maruti Suzuki Invicto, as well as the intermittent upgrades of popular models, provided an additional fillip to the growth of the segment.

Vans typically contributed 3-5% of the overall PV sales. The discontinuation of Maruti Suzuki Omni from fiscal 2020 for the implementation of BS-VI impacted the segment's market share. However, the sole model within the vans segment — Maruti Suzuki Eeco—continues to garner traction for commercial purposes after the discontinuation of Omni.

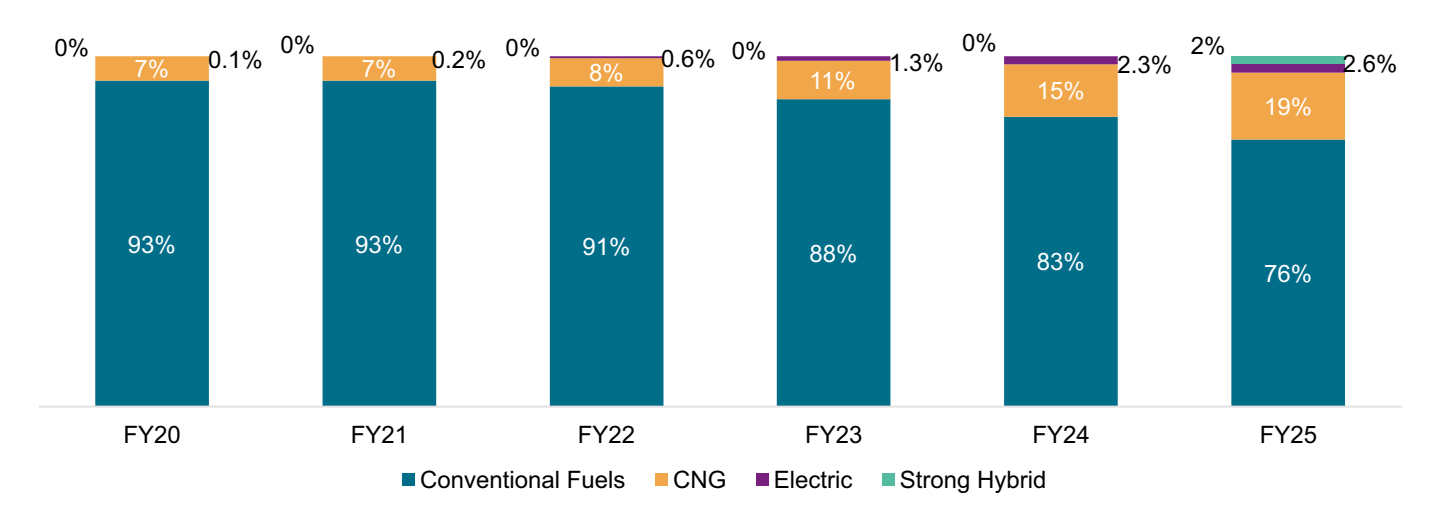
Changing powertrain mix in the Indian PV industry

Conventional fuel powertrains (petrol and diesel) have dominated the Indian PV industry for decades. Petrol vehicles were the preferred choice, despite diesel being cheaper than petrol, primarily because of their low purchase prices compared with diesel vehicles. However, the preference for diesel vehicles surged during fiscals 2012-2014 due to a rise in petrol prices and an increase in the price gap with diesel. Further, diesel vehicles offered better mileage.

However, the Supreme Court of India ordered a ban on diesel vehicles in the national capital region (NCR) to reduce air pollution and improve air quality. Moreover, a higher price rise in diesel vehicles following the implementation of emission norms (BSIV and BSVI) shifted the consumer preference towards petrol vehicles after fiscal 2015. Subsequently, the proportion of diesel PV retails in the industry dropped to 37% in fiscal 2019 from 48% in fiscal 2015.

Moreover, a shift in OEMs' focus to petrol vehicles from diesel vehicles, including the discontinuation of diesel models by a few OEMs such as Maruti following the onset of stricter BSVI norms, exacerbated the situation of diesel vehicles. In fiscal 2025, the share of diesel powertrain in the retail industry slid to only 18% from 32% in fiscal 2020.

Powertrain mix trend of PV industry retails



Note: Strong hybrid: Vehicles have a combustion engine, as well as an electric motor. The vehicle can be powered by the engine or the battery, or by both simultaneously. The battery of the vehicle is charged by the combustion engine and not by an external power source. Telangana and Lakshadweep retail data not available on VAHAN.
Source: VAHAN, Crisil Intelligence

The share of CNG vehicles more than doubled in the last five years to 19% of the overall industry retails in fiscal 2025. CNG vehicles were primarily preferred in the commercial (taxi) segment, limiting their contribution to 6-8%. However, the share of CNG powertrains rose to 19% in fiscal 2025 from ~8% in fiscal 2022 owing to the introduction of CNG powertrain options in premium hatchbacks and SUVs (Exter, Punch, Brezza, Fronx, Altroz, Baleno, etc.) due to rising acceptance of CNG among personal-vehicle buyers. Additionally, the fall in CNG fuel prices following the Kirit Parikh panel recommendation boosted CNG sales from fiscal 2024.

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The emerging EV segment also expanded its presence, especially in the last three years, backed by the launch of several EV models, expanding charging infrastructure, as well as a rise in climate consciousness. The share of electric vehicles in the overall retails increased to 2.6% in fiscal 2025 from 0.1% in fiscal 2019.

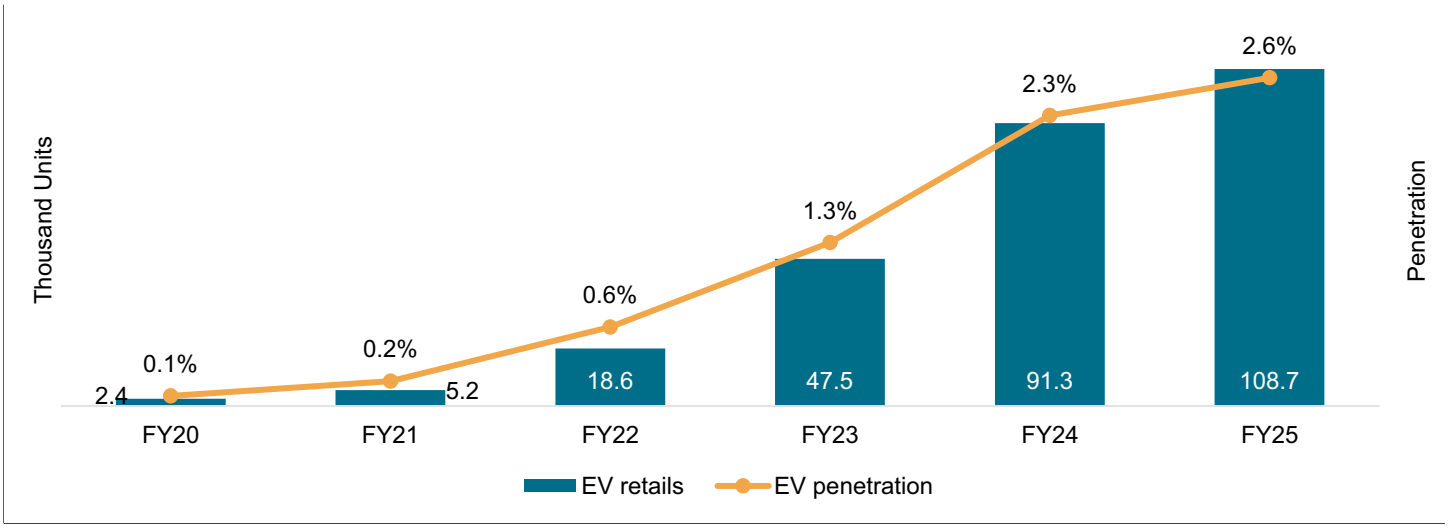
The recent launch of strong hybrid variants for a few models such as Maruti Suzuki Grand Vitara, Toyota Innova Hycross and Honda City introduced an additional powertrain option for Indian consumers. Hybrid powertrains witnessed healthy traction, with consumers seeking increased mileage at relatively low purchase prices. Lower operating costs, environmental benefits and a relief from the uncertainties faced by EV customers such as range anxiety or charging - station accessibility have boosted hybrid vehicle retail in the past two years.

Electrification within the domestic PV market

Amid rising environmental concerns, EVs are gaining traction globally, including in India. The country is one of the signatories to the Paris Agreement under the United Nations Framework Convention on Climate Change. It is also a part of the EV30@30 campaign, targeting a 30% sales share for EVs by 2030.

EV adoption in India is led by two-wheelers and three-wheelers; however, PVs are fast catching up. EV penetration in the PV segment was insignificant until fiscal 2021 amid a limited vehicle portfolio, coupled with lower customer awareness. However, a rapid expansion of the portfolio, rising environmental awareness, government support and expanding EV infrastructure have led to a sharp rise in EV adoption. In turn, the penetration of EVs within the retail industry rose to 2. 6% by fiscal 2025 from 0.1% in fiscal 2020.

Domestic EV retail and penetration of PVs



Note: VAHAN figures exclude Telangana and Lakshadweep retails
Source: VAHAN, Crisil Intelligence

With only a handful of vehicle options such as Reva and E Verito, EV adoption in passenger vehicles was inconsequential in fiscal 2019. However, Nexon EV, one of India's most popular EVs, was launched in the second half of fiscal 2020, providing a thrust to the adoption of passenger vehicle EV. The launch of Kona electric (H1 of fiscal 2020), as well as ZS EV (H2 of fiscal 2020) provided a further boost to the vehicle adoption in fiscal 2020. Continued traction for these models helped EV retail clock a sizeable growth in fiscal 2021. However, the pandemic decelerated the growth of EVs, given the high purchase prices, strained production levels, as well as financial pressure on the consumers.

However, the real impetus to EV adoption started in fiscal 2022. A gradual normalisation of the economy, an improvement in the macroeconomic landscape, an increase in mobility, an expansion in the EV portfolio and continued government

support aided growth in EV adoption. Moreover, a further rise in ICE vehicle prices, a sharp hike in petrol and diesel prices, an increase in customer awareness and younger buyers provided an added impetus to EV adoption.

The entry of new players such as BYD, as well as the introduction of models such as Tiago EV, Tigor EV, Punch EV, XUV400, Comet EV, eC3, Ioniq and Atto 3 in a short span of time provided the thrust to EV adoption. In fact, the introduction of Tiago and Comet in the hatchback segment and Tigor in the sub 4-metre sedan segment expanded the customer reach for EVs. Traction for Tigor for commercial-fleet usage further aided growth in the EV growth.

During fiscals 2020-2025, EV retails increased sharply (45x), translating into 2.6% EV penetration in fiscal 2025. New EV launches, especially during the second half of fiscal 2025, such as Windsor, Creta EV, BE6 and 9E supported the expansion in EV penetration in fiscal 2025.

Aided by continued traction for these latest launches, fiscal 2026 started on a positive note for EVs with the penetration rising to 4.2% in the first quarter.

However, electrification in the PV segment is still at a nascent stage, and there is a significant scope for expansion.

Our outlook on the domestic PV industry

The domestic PV industry logged a CAGR of ~9% between fiscals 2020 and 2025 on a high base of fiscal 2020 despite the lull during the pandemic, led by significant traction in the SUV segment, increased vehicle launches, coupled with the entry of new players. A relatively lower impact on the disposable income of the upper middle class led to healthy growth in the SUV segment, driving overall PV sales. In turn, the industry reached historic high sales of ~4.3 million vehicles in fisc al 2025.

Despite healthy growth, car penetration in India, at 27 per 1,000 people in fiscal 2025, was still much lower than that of global peers such as China (195), Mexico (286), Brazil (281) as well as developed countries such as the US (591), the UK (496), Japan (497) and Korea (406). Thus, there is a lot of headroom for growth in the domestic market.

We expect the macroeconomic scenario to support industry growth with GDP projected to grow at a healthy pace between fiscals 2025 and 2030. India's GDP growth is projected to outperform other major geographies over the next five years at 6.5-7.5%. Inflation levels are also forecast to remain subdued in the 3-5% range, which is within the RBI's target band. We have assumed three years of normal monsoon within the five-year outlook period and have considered positive momentum in rural demand. Fuel prices are also expected to remain near steady in the next five years. These favourable macroeconomic factors are expected to support consumer disposable income.

Besides these macroeconomic factors, continued government support in terms of policies as well as continued expenditure and investments are expected to boost the industry. The favourable demographics are an added advantage for India and are expected to help propel the PV industry.

Additionally, OEMs are expected to continue to launch feature-rich, competitively-priced vehicles, aiding overall demand growth.

The financing scenario is likely to remain favourable for the industry and lend further support amid expanding financing reach and high loan to value (LTV) levels. Moreover, after multiple rate hikes in the past two years, a rate cut of 100 bps in 2025 and a further rate cut expected in this fiscal are likely to keep interest rates competitive in the near term.

Changing market dynamics, including a younger consumer base, premiumisation, electrification, shorter replacement cycles (4-5 years currently vis-a-vis 7-8 years, a decade ago) will provide further impetus to demand. Additionally, the government's push for scrapping old vehicles (as per the government regulation, vehicles above the age of 15 years will be compulsorily scrapped) is expected to shorten replacement cycles and support demand.

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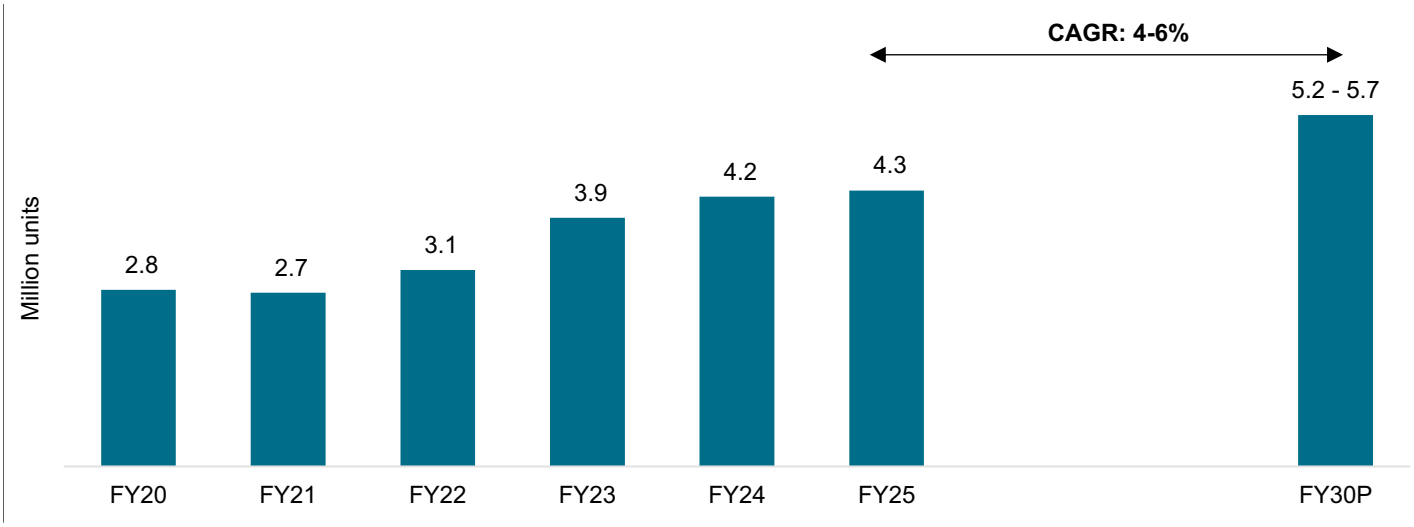
Further, capacity expansion by players such as Maruti Suzuki, Hyundai and Tata Motors is expected to support growing demand for vehicles. Moreover, expansion of supporting infrastructure such as EV charging stations and CNG pumps will also enhance the choice of customers in terms of powertrains.

We expect domestic sales to grow at a CAGR of 4-6% between fiscals 2025 and 2030 to 5.2-5.7 million vehicles.

Outlook for domestic PV industry



Source: SIAM, Crisil Intelligence

Segmental outlook

Looking ahead, the next five years are likely to see SUVs cementing their position as the primary growth driver of the PV industry. Hatchbacks and sedans may witness only modest or muted growth. The overall industry growth will be supported by this shift towards larger, premium and utility-oriented vehicles, in line with rising income levels, urban lifestyle changes, and a stronger focus on safety and comfort features. Domestic industry growth is expected to be led by the SUV and MPV segments, while the hatchback, sedan and van segments are expected to clock muted growth.

Outlook on electrification in the industry

The electric PV sector is poised to see a significant surge in growth over the next five years, driven by a combination of factors, including a supportive policy framework, declining battery costs, an expanding network of charging infrastructure, and an increase in consumer awareness and acceptance. Original equipment manufacturers (OEMs) are intensifying their investments in R&D for EVs and are aggressively expanding their EV product portfolios, with a multitude of launches scheduled across various segments in the forthcoming years.

Furthermore, it is anticipated that the decreasing cost of batteries will offset the reduction in government subsidies, thereby enhancing the competitiveness of battery electric vehicles (BEVs) and leading to a further improvement in the total cost of ownership (TCO) for EVs. This, in turn, is expected to incentivise the transition towards electrification. Moreover, ride-hailing platforms such as Uber, Ola, Rapido, and Namma Yatri are adopting EVs due to the associated TCO benefits, and the increasing electrification of fleet is expected to provide an additional impetus to the industry's transition towards EVs.

The government's support for the expansion of charging infrastructure is also expected to alleviate customer concerns regarding the range of EVs, thereby further facilitating the adoption of EVs. Furthermore, the entry of global players, like Tesla and VinFast, will also aid electrification in the longer term.

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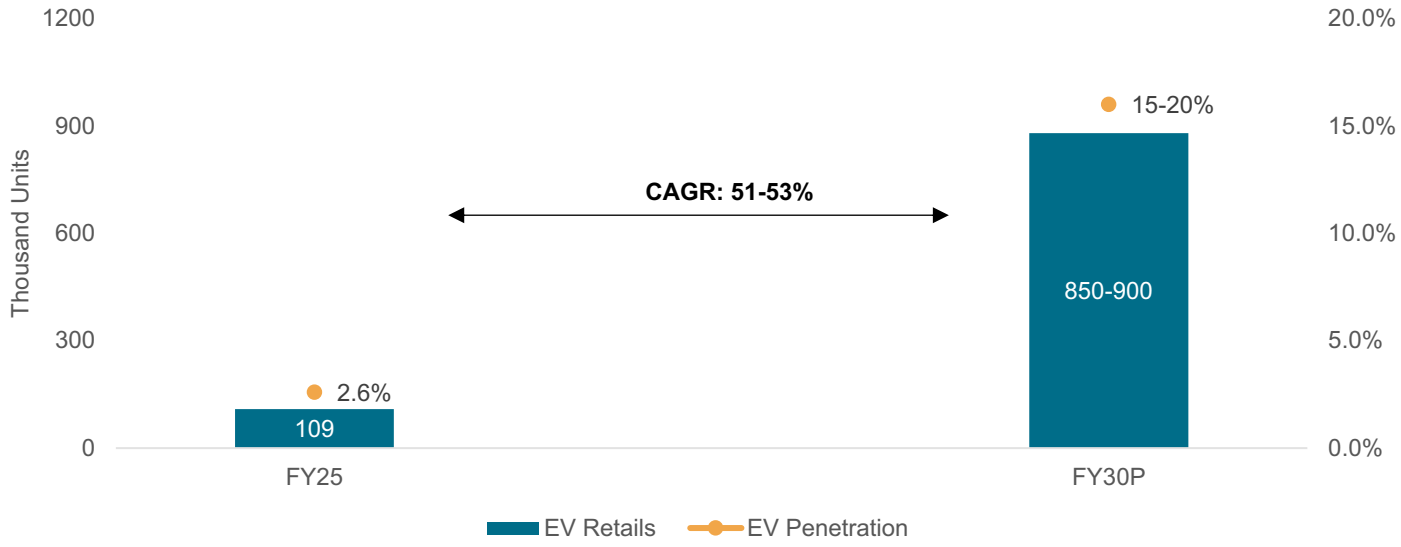
However, the impact of the rare earth crisis and the current global political scenario bears watching.

Over the long term, the share of EVs in total passenger car sales is projected to increase to 16-21% by fiscal 2030, from the 2.6% recorded in fiscal 2025. Additionally, EV sales are forecasted to reach 850 to 900 thousand units by fiscal 2030, clocking a compound annual growth rate (CAGR) of 51-53%.

EV penetration outlook for PVs



Source: VAHAN, Crisil Intelligence

Exports

Domestic sales dominate the PV industry with more than 80% share. India primarily exports to developing regions including Africa, Latin America and Asia, which account for more than 90% of exports from India.

Between fiscals 2020 and 2025, domestic sales rose at a faster pace of 9.3% CAGR, while exports grew at a relatively subdued pace of 3.2% CAGR. The relatively slower growth in exports could be attributed to the moderate growth in the global automobile industry as well as major OEMs focusing on catering to the fast-growing domestic market.

In fiscal 2020, the export share had risen to 19% (from 17% in fiscal 2019) as OEMs refocused on the export markets. Stagnating domestic sales resulted in foreign automobile manufacturers such as Ford, General Motors (GM) and Volkswagen increasing their focus on exports, thereby improving their capacity utilisation and boosting revenue. These players were using India as an export hub. However, with the exit of GM and Ford, the impact of the pandemic and major OEMs prioritising the fast-growing domestic market over foreign markets, export volumes declined through fiscal 2021.

Notably, exports recovered quickly after the pandemic, growing at a faster rate of 17.5% per year from a lower base in fiscal 2021, when they had dropped 38% compared with a 2% decline in domestic sales.

After dropping ~38.6% on-year in fiscal 2021, exports improved significantly by 42.9% in fiscal 2022, 14.7% in fiscal 2023 and 1.4% in fiscal 2024 owing to demand from emerging countries, further supported by a push from major OEMs amidst the intensifying competition in the domestic market.

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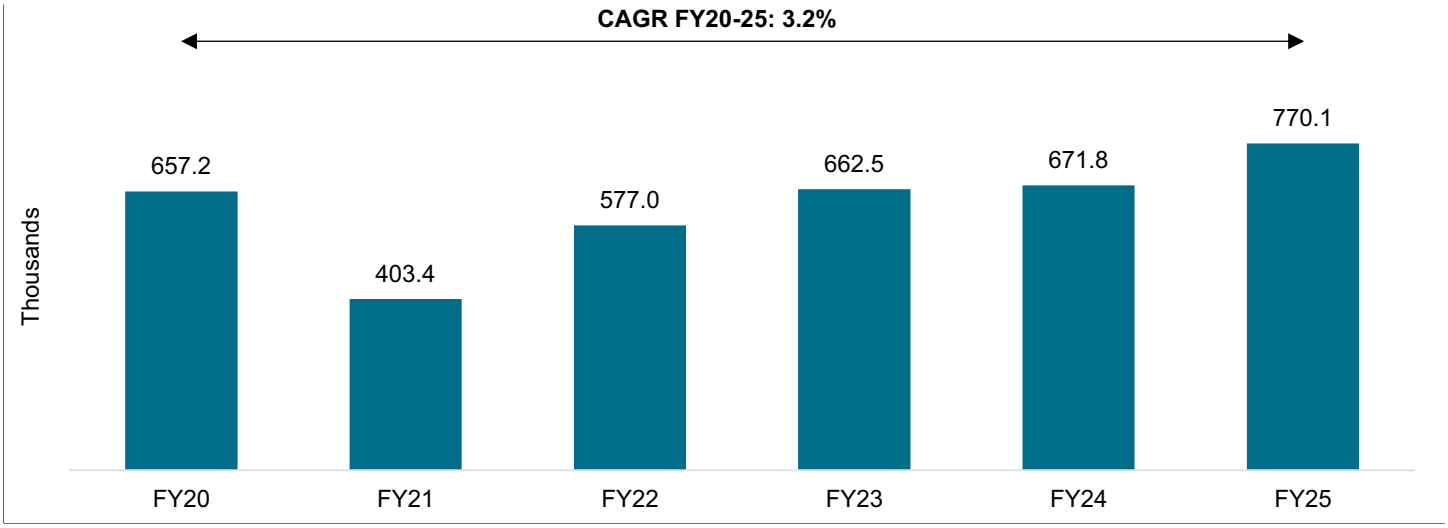
In fiscal 2025, industry exports clocked a healthy 15% growth, aided by the doubling of UV exports from India. Expansion in the portfolio as well as rising demand for UVs supported this sharp growth. On the other hand, exports of cars witnessed a 7% drop, reducing the share of cars in the industry exports to 52% during the year vs 64% in fiscal 2024.

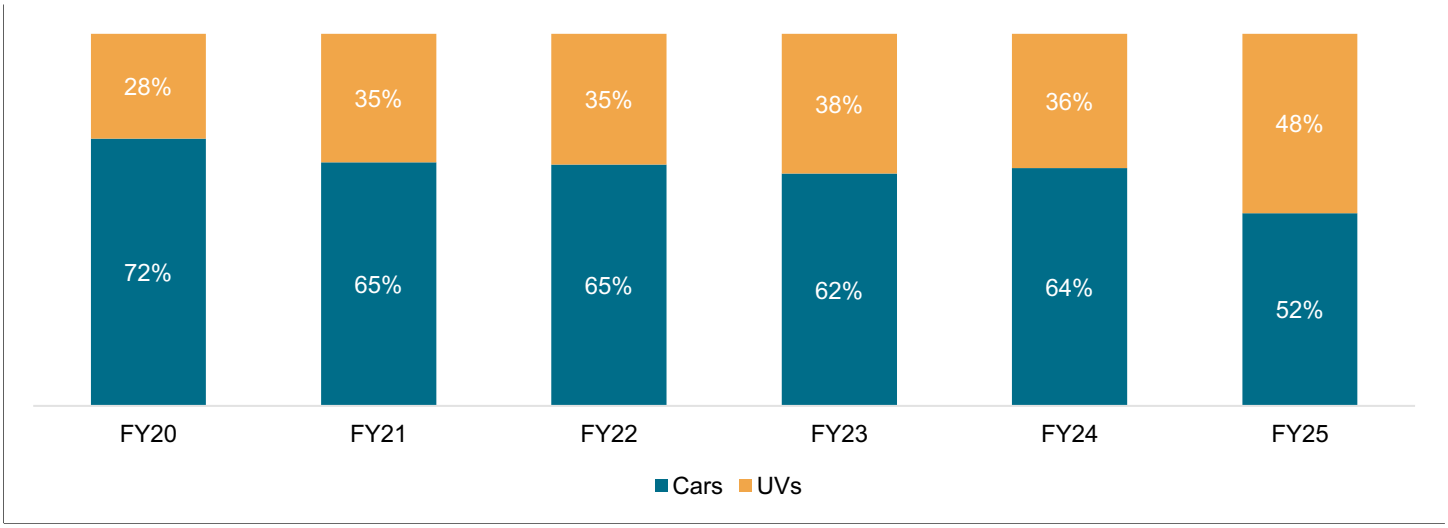
The momentum in industry exports is expected to continue with an 11-15% growth in fiscal 2026. The UV segment is projected to grow at a faster pace of 22-25%.

Exports trend



Source: SIAM, Crisil Intelligence

Segmental split in exports



Source: SIAM, Crisil Intelligence

Crisil Intelligence

Review of and outlook on the two-wheeler industry

The current landscape

The two-wheeler segment sees a healthy demand in India as two-wheelers are preferred over four wheelers by a majority of the Indian population, especially for their regular commute. This is primarily due to the lower acquisition cost, higher mileage, lower maintenance costs, ease of navigation, especially during peak traffic hours, hassle-free parking and suitability on rugged roads.

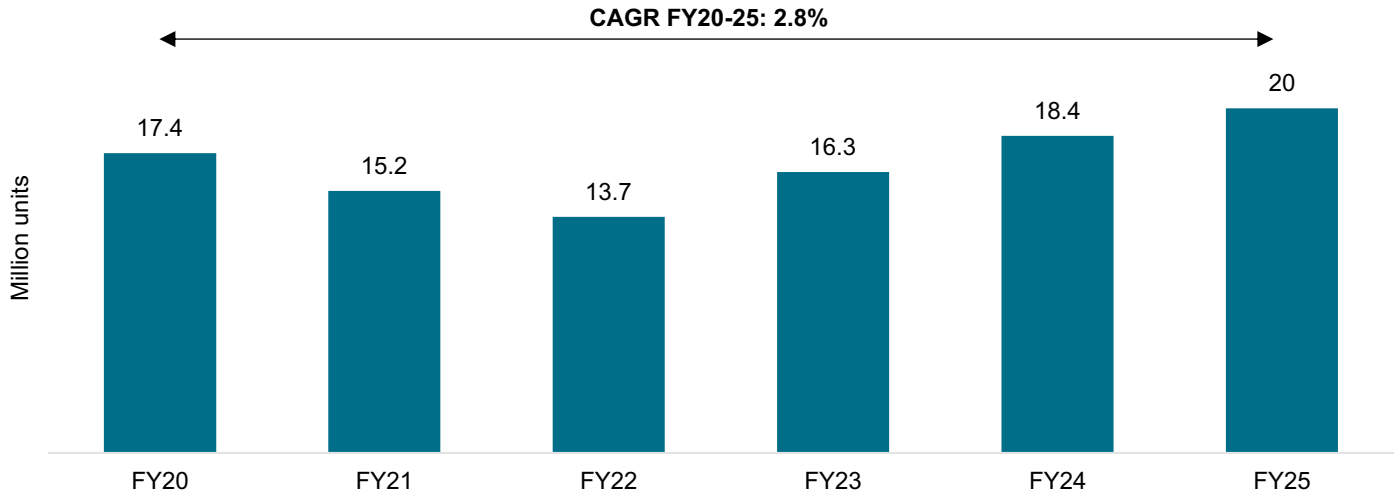
Domestic sales, which account for more than 80% of the total sales of the industry, clocked a CAGR of 2.8% between fiscals 2020 and 2025.

The domestic industry witnessed a sharp drop at 11.4% CAGR between fiscals 2020 and 2022 amidst the pandemic and reached a low of 13.7 million in fiscal 2022. Nationwide lockdowns, closure of schools /colleges/ offices, and reduced mobility impacted two-wheeler sales during the period.

From the reduced base of fiscal 2022, domestic sales rebounded in fiscal 2023 and recorded a healthy growth of 19%, driven by improving demand sentiment, normalisation of economic activities and increased mobility. The pent-up demand due to the postponement during the pandemic and a sharp rise in the demand for scooters with the restarting of colleges and offices provided a boost to demand.

However, the higher interest outgo with increase in repo rates and further hike in vehicle prices restricted the growth of domestic sales in fiscal 2023.

Domestic sales trend



Note: Data for ICE and EVs, EVs are the retail data based on VAHAN;
Source: SIAM, VAHAN, Crisil Intelligence

In fiscal 2024, domestic sales increased 13%, supported by further improvement in the macroeconomic scenario, rural support, and continued traction for premium motorcycles and scooters. In addition, continued demand for electric two-wheelers despite the subsidy cut supported the growth in fiscal 2024. New launches, especially in the premium segments provided additional support to the demand. The commuter motorcycle segment also saw some improvement during the year after consecutive contractions, aided by limited rise in operating costs as well as increased customer incentives.

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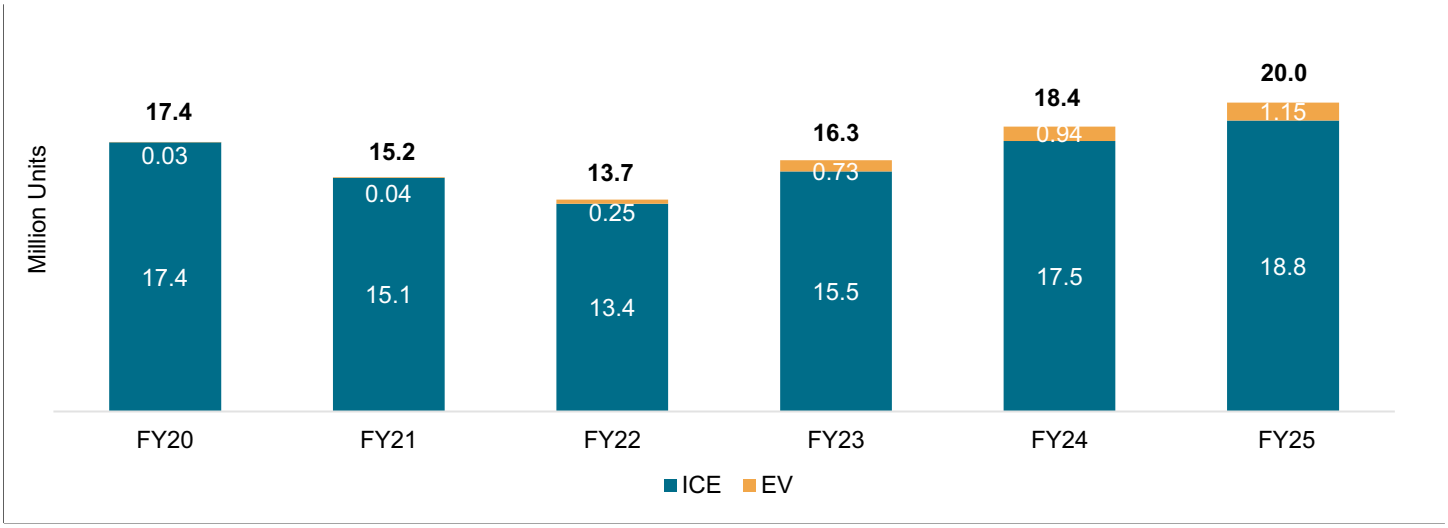
In fiscal 2025, industry sales clocked 20 million units, up 8% on-year. As per the Federation of Automobile Dealer Association (FADA), the two-wheeler market grew 8.4% in rural areas compared with 6.8% in the urban areas in fiscal 2025. The growth has been driven by recovery in the rural market, aided by healthy crop prices, robust urban incomes and rising demand for scooters in the rural market. Continued demand for premium vehicles as well as electri fication provided additional support to the domestic market during the year.

Between fiscals 2020 and 2025, sales in the domestic market grew at 2.8% CAGR to reach ~20 million units.

Domestic two-wheeler sales volume trend (ICE vs EV)



Source: SIAM, VAHAN, Crisil Intelligence
Source: VAHAN, CRISIL Intelligence

y-o-y growth	FY20	FY21	FY22	FY23	FY24	FY25	FY20-25 CAGR
ICE	-17.8%	-13.2%	-11.1%	15.5%	12.7%	7.6%	1.6%
EV	-4.1%	67.0%	464.1%	187.9%	28.5%	22.9%	112%

Source: SIAM, VAHAN, CRISIL Intelligence

In the past five years, electrification in the industry has significantly contributed to growth in overall industry sales. In fiscal 2022, electric 2-wheelers logged the highest growth. The sharp rise in EVs was driven by the government's push for EV adoption and increasing consumer interest in EVs.

Even when ICE vehicle sales declined slightly in fiscal 2022, the sharp rise in EV sales restricted the drop in the overall 2W sales volume. During fiscal 2020 to 2025, the ICE segment grew marginally by 1.6 %. However, EV sales grew at a CAGR of 112% during the period. In fiscal 2025, EV penetration was ~5.8% and EV volumes reached 1.15 million units.

Electrification in the 2W industry

EVs are gaining global interest due to their potential to curb pollution. In India, EVs are gaining popularity as the government is extending support through the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME II) scheme, the EMPS subsidy scheme, the latest PM E-drive subsidy, the state subsidy and tax rate cuts for EV adoption. Further, growing awareness about environmental issues are likely to drive electrification in India.

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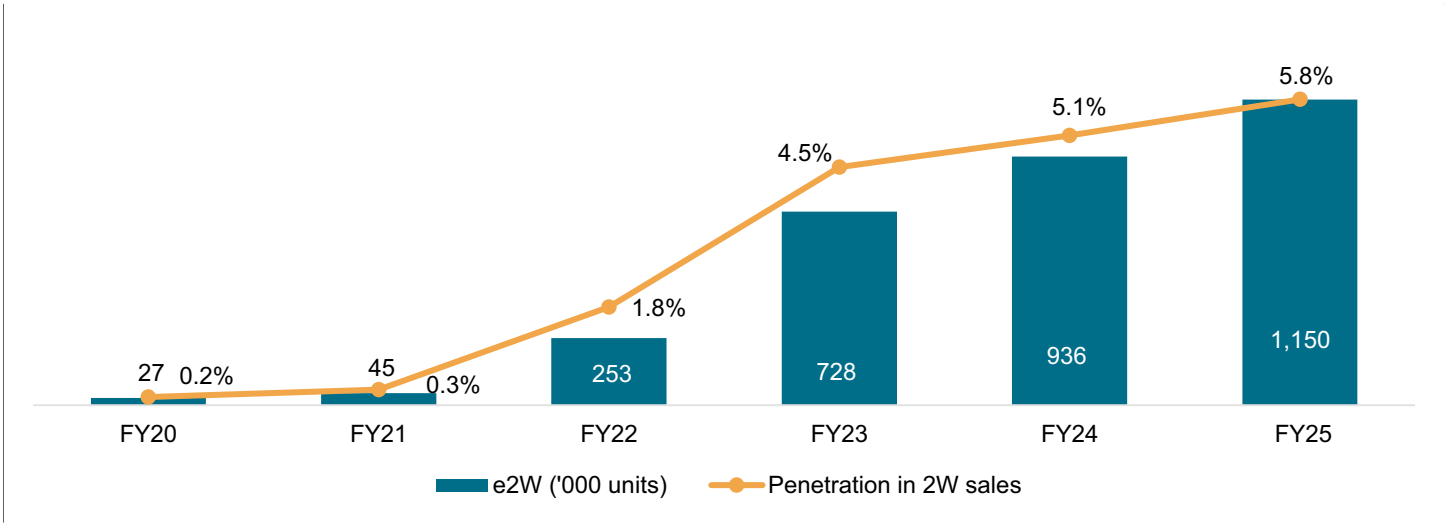
EV sales have grown, especially during the post-pandemic phase, aided by rising awareness, government support and the expanding EV portfolio of the industry. The entry of the new-age non-traditional OEMs, such as Ola, Ather, Okinawa and Ampere have provided an additional boost to the EV segment in India.

EV retails trend



Note: Only two high-speed electric wheelers have been considered for the analysis
VAHAN data does not include Telangana and Lakshadweep retails.
Source: VAHAN, Crisil Intelligence

The high-speed electric two-wheelers have propelled momentum in the electric two-wheeler, increasing at a rapid pace from 27 thousand units in fiscal 2020 to 1,150 thousand units in fiscal 2025, clocking a CAGR of 112% in the period. The healthy growth in electrification was encouraged by increasing awareness, government support, lower total cost of ownership of EVs compared with their ICE counterparts, the narrowing gap between the acquisition cost of EV and ICE parallels, lower maintenance, new-age advanced features and the expanding EV portfolio of the industry. The penetration level for EV grew from 0.2% in fiscal 2020 to 5.8% in fiscal 2025.

Going ahead, the rise in electrification is expected to contribute significantly to the industry growth over the long term.

Our outlook on the domestic two-wheeler industry

The industry is expected to continue its growth momentum over the long-term, led by the positive microeconomic and macroeconomic environment, favourable rural demand, premiumisation, intermittent launches, shrinking replacement cycle and continued support from financers. Moreover, the continued R&D investments by the OEMs and the technological advancements in the industry will also provide an additional support to the industry over the long-term.

In addition, the fast-rising EV segment, with EV portfolio expansion by legacy players, capacity expansion by new-age players will accelerate the industry growth.

The introduction of CNG powertrain, offering lower operating costs compared with petrol variants, will further boost the industry.

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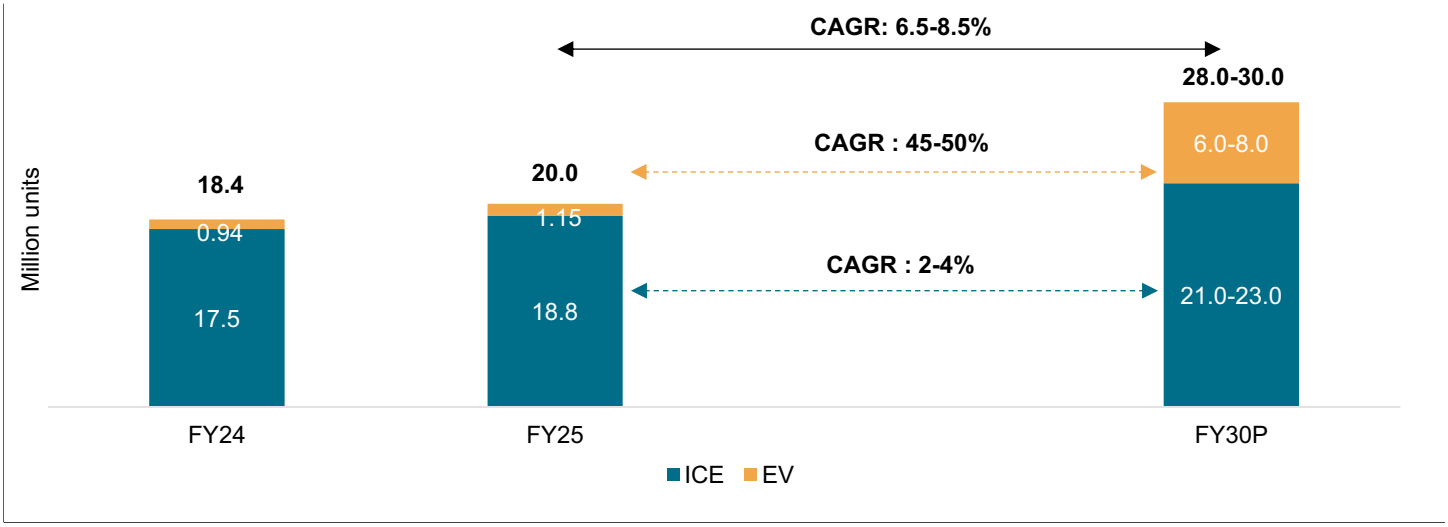
Domestic two-wheeler sales volume trend outlook (ICE vs EV)



Source: SIAM, Vahan, Crisil Intelligence

In the domestic two-wheeler market, the scooter segment is expected to experience a faster growth rate compared to other segments driven by an expected sharp rise in e-scooter demand, ubiquitous usage of scooters, rising share of women in the workforce, projected growth of the e-commerce segment, coupled with the continued focus of OEMs on the scooters segment. The strong launch pipeline, especially for e-scooters and faster replacement cycles of the scooters segment will also support faster growth. Further, improvements in supporting charging infrastructure is expected to provide an impetus to the segment's growth.

Outlook on e-2W segment

The electric two-wheeler retails clocked a CAGR of 112% in the past five years, albeit off the small base of fiscal 2020. Going ahead, the growth momentum in the industry is expected to continue over the long-term, led by rising awareness, improving the total cost of ownership for electric vehicles, the bridging acquisition cost gap between EV and ICE counterparts, larger vehicle portfolio, expanding charging infrastructure, furthering financing support, increasing EV manufacturing capacity and the continued government support.

As the government continues with the demand incentive at least for the next one year (till fiscal 2026), we expect the EV retails to rise at a healthy CAGR of 45-50% to reach a volume of 6-8 million in fiscal 2030 and the EV penetration to reach 22-27% by fiscal 2030. These expansions will make e2Ws one of the fastest growing segments in the automotive industry in India.

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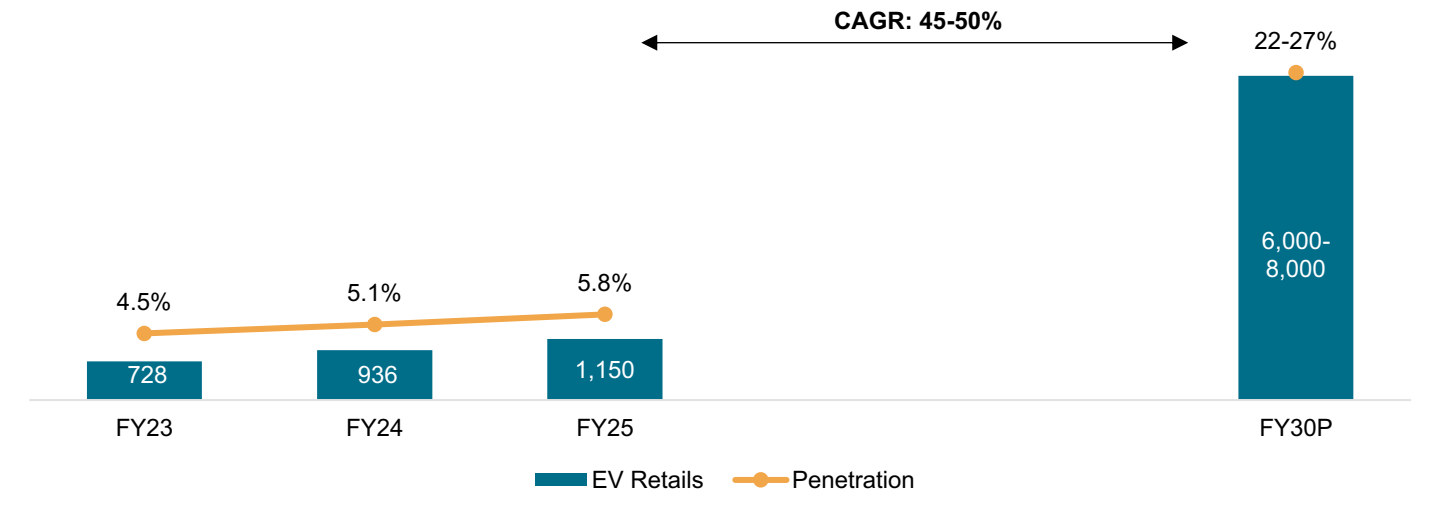
e2W Outlook



Note: Only high-speed electric two-wheelers have been considered for analysis,
Source: SIAM, VAHAN, Crisil Intelligence

Exports

Exports typically account for 15-20% of the overall two-wheeler sales in India. Two-wheelers are primarily exported to developing countries from India and Africa accounting for a major share. However, exports to Africa have been under pressure amid the slowdown in the economy, sharp rise in inflation and the unavailability of foreign exchange (forex) in Nigeria, which is one of the leading two-wheeler importers.

Between fiscals 2020 and 2025, two-wheeler exports logged a CAGR of 3.6%, reaching 4.2 million in volume in fiscal 2025 from 3.5 million in fiscal 2020, led by an increase in global demand and entry into new markets, such as the US, Europe and the Middle East, by players such as Bajaj and TVS. Also, joint ventures with global brands, such as KTM, Husqvarna and BMW, and catering to the global demand of these brands from India has given an additional thrust to two-wheeler exports.

However, tightening global monetary conditions after the inflation spiral and forex unavailability limited the exports. Geopolitical conflicts have also been impacting overseas demand.

From fiscal 2020 to fiscal 2025, share of exports within the total sales remained near steady between 16-18% with fiscal 2022 being an exception, when the shipment rose to a healthy 24% as OEMs focused on exports amid a slowdown in the domestic market.

With the domestic market witnessing a revival after the Covid-19 pandemic, the focus of OEMs primarily remained on the market, with the share of exports normalising to 18% in fiscal 2023. In fiscal 2025, two-wheeler exports increased 21.4% to reach 4.2 million units, driven by portfolio expansion and a rise in demand from key regions such as Africa and Latin America. Sharp 23% rise in motorcycle exports aided this growth.

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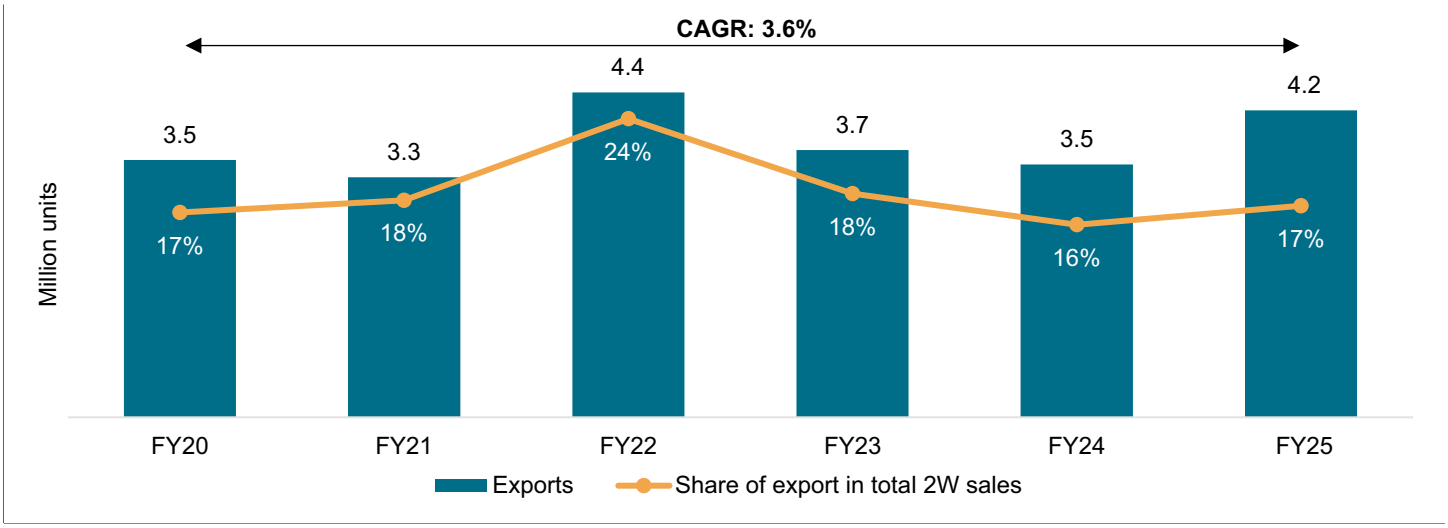
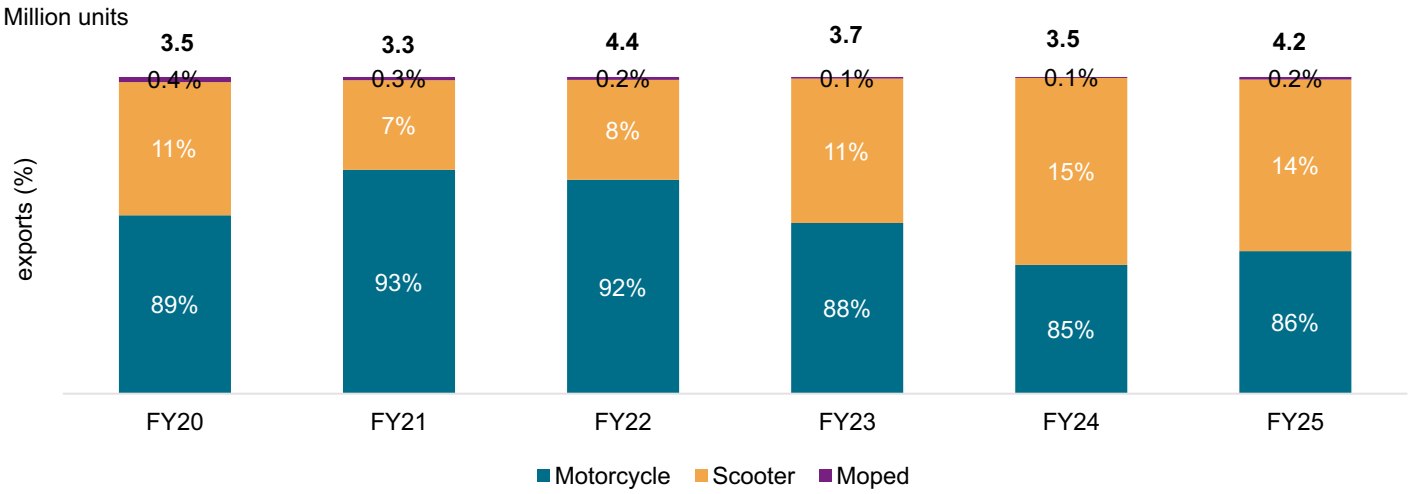
Two-wheeler exports trend



Source: SIAM, Crisil Intelligence

Segment-wise export share for fiscal 2020-2025



Source: SIAM, Crisil Intelligence

Going ahead, two-wheeler exports are projected to continue their growth momentum albeit at a slightly taped pace of 13 - 17% off the elevated base of fiscal 2025. An improvement in the economic environment in major exporting destinations, including Africa, and neighbouring countries, such as Sri Lanka and Bangladesh, coupled with the portfolio expansion, is expected to support the exports growth.

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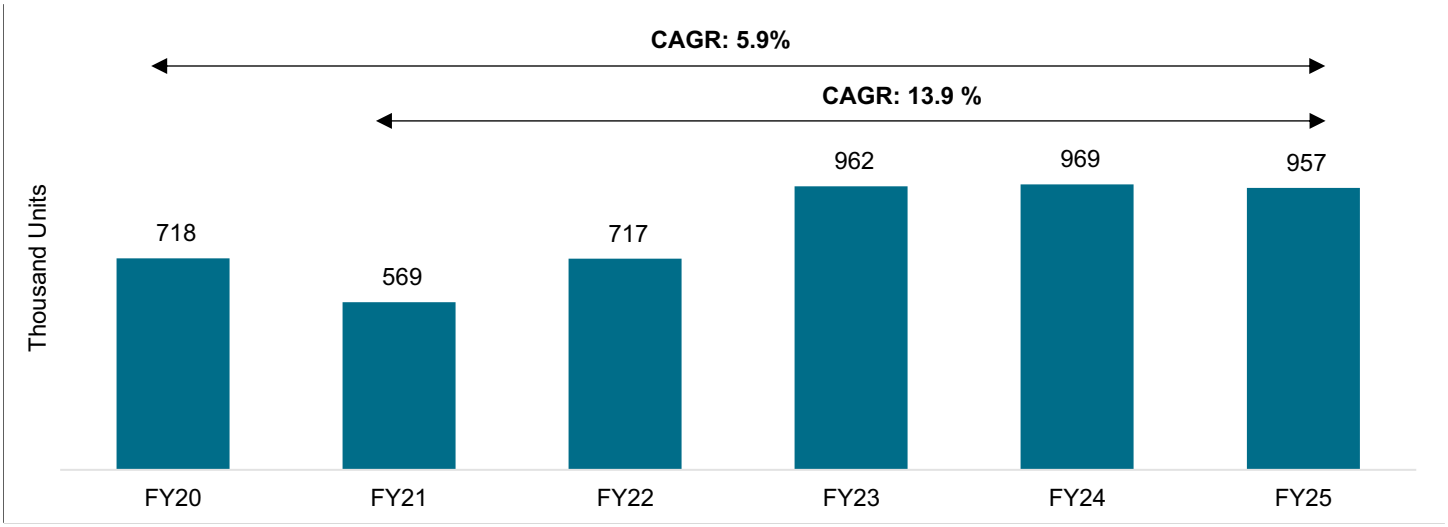
Review of and outlook on the commercial vehicle industry

The current landscape

India is the third-largest commercial vehicle (CV) market in the world, with domestic sales and exports volumes of 1.04 million units in fiscal 2025. The volumes have consistently been over 1 million units over the past three fiscal years, indicating a healthy demand in the market, albeit at a steady level. The CAGR over the past five years has been 5.9%, driven by e-commerce surge in the country and the increasing number of infrastructure development projects.

The larger domestic segment contributed more than 90% of the industry, which saw a 21% drop in fiscal 2021 due to Covid restrictions. However, the segment rebounded at a CAGR of ~14% between fiscal 2021 to fiscal 2025, with the resumption of economic activity and improved mobility. The sharp rise after the pandemic was led by the buses segment, which clocked a sharp 58% CAGR between fiscal 2021 and fiscal 2025, followed by a 19% growth in the IMHCV segment. LCVs Light commercial vehicles, the largest segment, clocked a 7% growth during the period.

Domestic sales trend



Source: SIAM, Crisil Intelligence

The market is split into three segments: LCV (<7.5 tonnes), IMHCV (>7.5 tonnes) and buses. The LCV segment, which includes goods carriers less than 7.5 tonnes, experienced a notable shift in its market share. In fiscal 2019, LCVs accounted for 48% of total CV sales, supported by strong demand for the last-mile delivery and urban freight movement. However, as economic conditions deteriorated in fiscal 2020 and fiscal 2021, LCV penetration surged to 62% and 70%, respectively, as businesses prioritised smaller vehicles to maintain operational flexibility amid declining fr eight availability.

The post-pandemic recovery in fiscal 2022 and beyond saw the LCV market share gradually normalise to 55% by fiscal 2025. LCV sales volumes in fiscal 2025 suggest potential challenges due to higher fuel prices, financing constraints and evolving fleet preferences.

The light commercial vehicle (LCV) sales declined 3% in fiscal 2025. Despite an increase in volume up for replacement compared with past years, the general slowdown in economic activity exerted downward pressure on LCV sales. Reduction in construction activities, along with subdued demand for the last-mile delivery and e-commerce activities due to declining urban spending and extended rainfall, impacted the segment.

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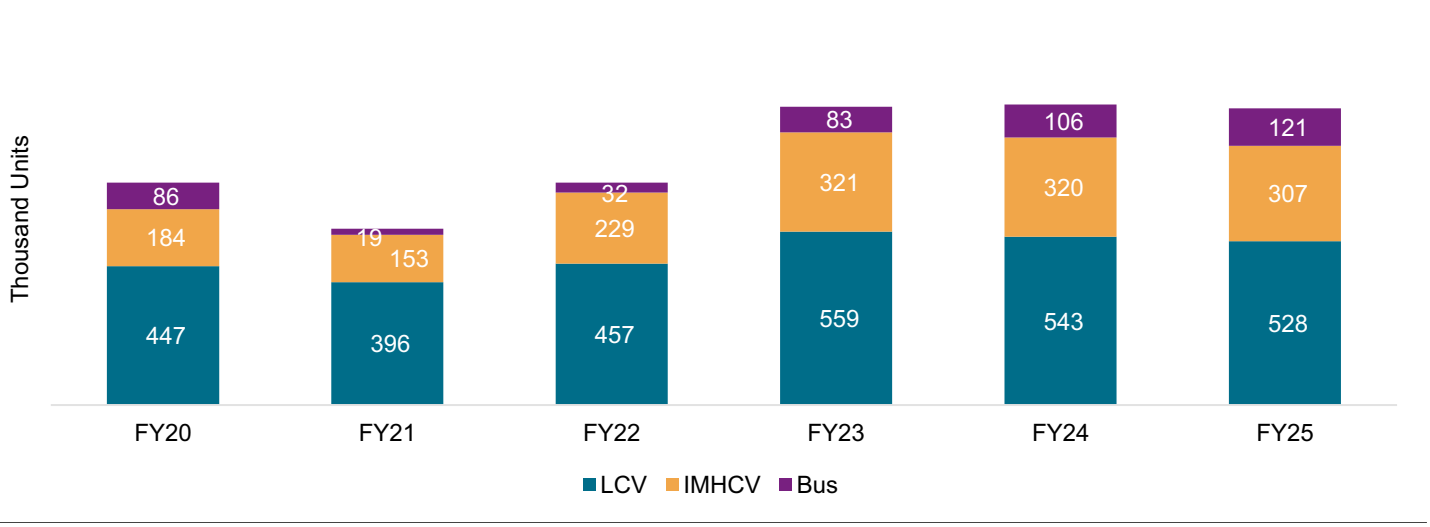
Domestic sales split by segment



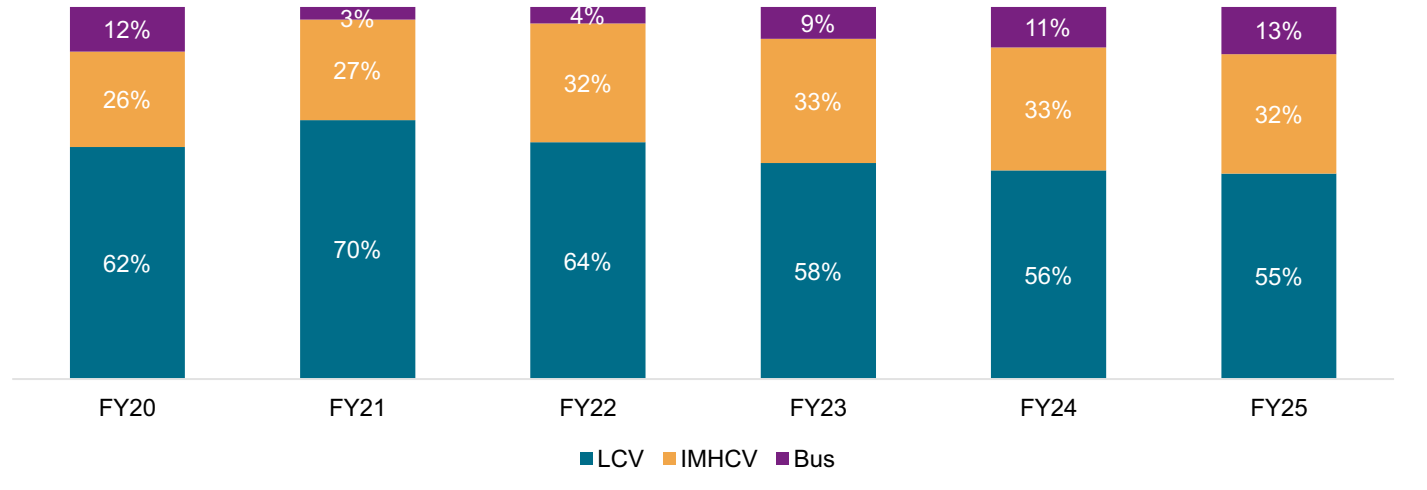
Source: SIAM, Crisil Intelligence

The domestic IMHCV industry experienced notable volatility in sales volumes over the past few fiscal years, shaped by economic downturns, pandemic-induced disruptions and a gradual recovery, backed by infrastructure spending and replacement demand.

In fiscal 2020, the IMHCV market contracted sharply to 184 thousand units due to a downturn in economic activities and weakened fleet demand. The situation worsened in fiscal 2021, with volumes falling further to 153 thousand units as industrial activities slowed and fleet operators deferred capital expenditure amid pandemic uncertainties.

However, the segment regained traction in fiscal 2022, recording a notable recovery to 229 thousand units, driven by improved freight availability and a gradual uptick in infrastructure projects. This positive momentum accelerated in fiscal 2023 as sales rose significantly to 321thousand units, supported by strong replacement demand, rising freight rates, and enhanced fleet utilisation. In fiscal 2025, IMHCV sales witnessed some contraction, indicating a maturing demand cycle, influenced by cautious expansion strategies and a possible saturation in fleet replacement activity.

Segment-wise contribution of domestic CV Industry



Source: SIAM, Crisil Intelligence

The bus segment, catering to public and institutional transportation, saw a steep decline during the pandemic, with volumes plunging from 86 thousand units in fiscal 2020 to a mere 19 thousand in fiscal 2021, owing to school closures, reduced inter-city travel and lower demand in the public mobility space. However, a gradual rebound began in fiscal 2022, and gained momentum from fiscal 2023, with sales improving at a CAGR of 58% to 1,21 thousand units in fiscal 2025, supported by public transport services, growing demand for low emission buses (CNG and electric) in metro and tier-2 cities and fleet modernisation initiatives.

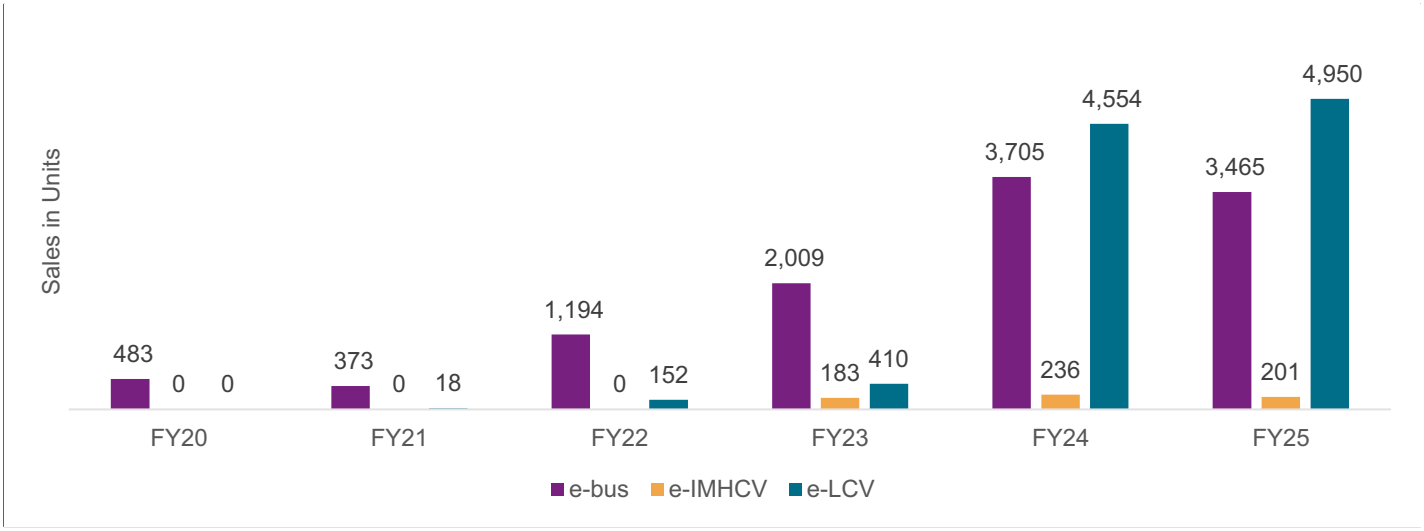
The share of buses in total domestic sales increased from 3% in fiscal 2021 to 13% in fiscal 2025, led by a sharp rise in sales.

Electrification in the domestic CV industry

Electrification in the CV industry has been slower than in the other vehicle industries because of significantly higher upfront costs (due to the larger size of the lithium-ion battery pack to meet operational demands), lack of charging infrastructure, etc.

Among CVs, the bus segment was the first to be electrified as state transport undertakings (STUs) procured e-buses through Gross Cost Contracting (GCC) models, supported by government policies. Electrification of the LCV segment followed. The share of EVs in the CV industry increased from 0.1% in fiscal 2020 to 0.9% by fiscal 2025.

EV sales by segment



Source: SIAM, VAHAN, Crisil Intelligence

In the LCV segment, EV penetration is about 1%. As the cost differential between electric and diesel vehicles narrows, we expect new EV models to be launched. This will drive sales of e-LCVs, as third-mile logistics and local distribution of goods are well-suited applications for EVs. Tata Ace EV, Omega M1KA, JEM Tez and Switch Mobility EV are some of the e-LCVs in the market.

The bus segment has the highest EV penetration in the CV industry, rising from 0.6% in fiscal 2020 to ~3% by fiscal 2025.

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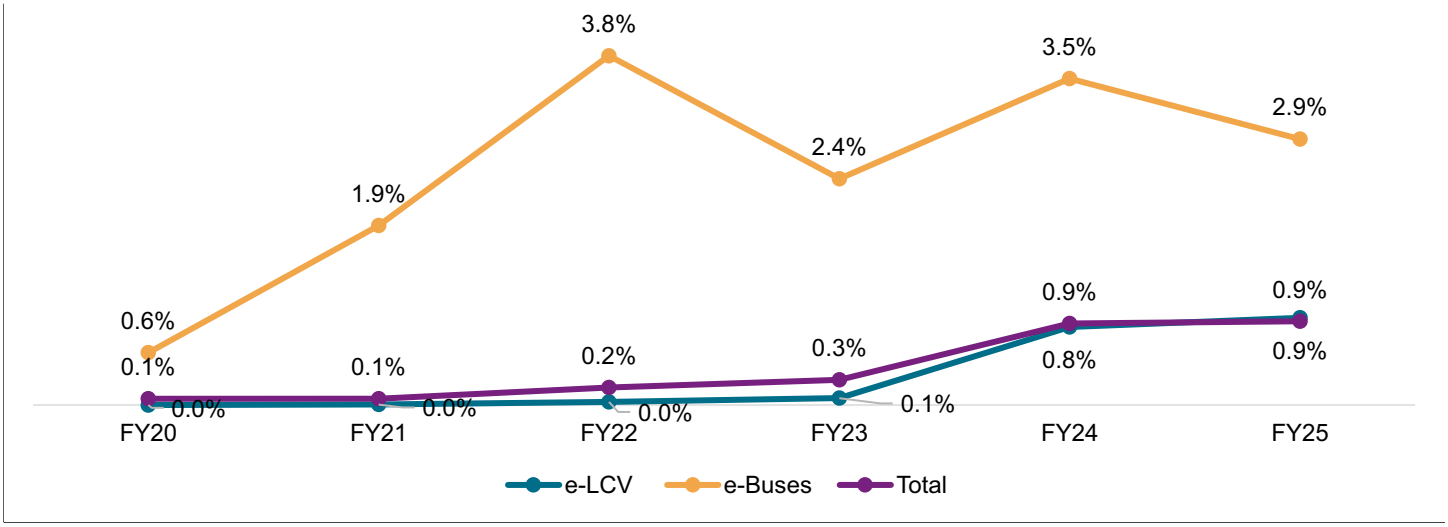
EV penetration

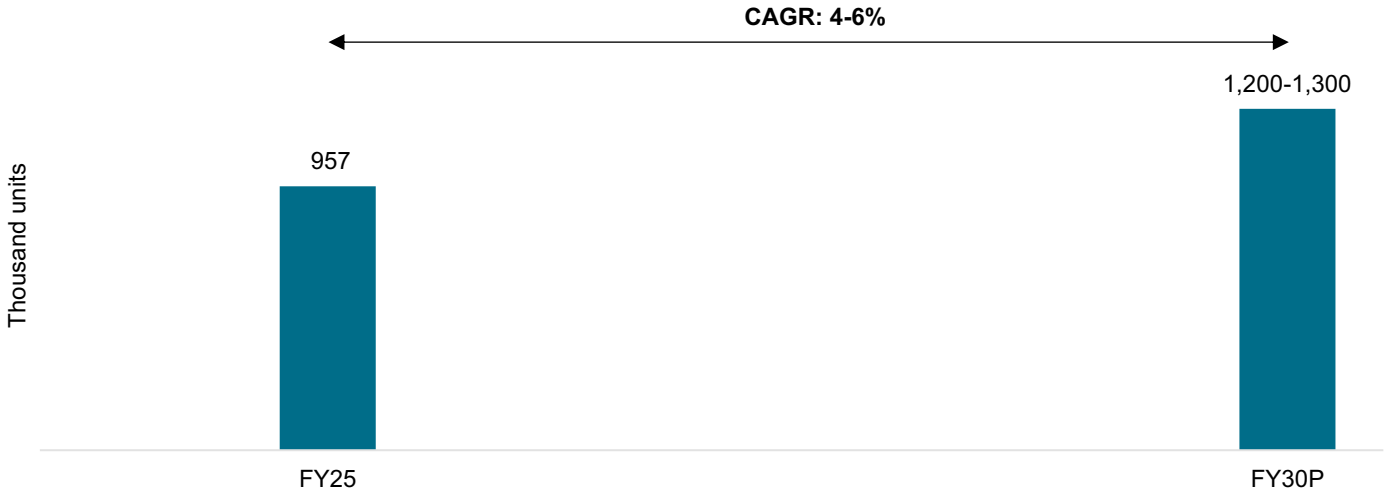


Source: SIAM, VAHAN, Crisil Intelligence

Our outlook on the domestic CV industry

The CV industry is expected to grow from 957 thousand units in fiscal 2025 to 1,200-1,300 units in fiscal 2030, at a CAGR of 4-6%.

CV outlook



Source: SIAM, Crisil Intelligence

LCV segment outlook

LCV demand is expected to log a CAGR of 3.5-5.5% between fiscals 2025 and 2030. It clocked a CAGR of 3% between fiscals 2020 and 2025 due to sustained demand (despite the impact of the pandemic) and increased e-commerce activity.

In fiscal 2026, the LCV segment is projected to grow 1-2%, driven by replacement volumes from healthy sales over fiscals 2017-2019, the resumption of government spending to usual levels, and increased construction and mining activities supported by a 9-11% higher budgeted construction capex. Additionally, the lowering of repo rates and higher loan disbursements are expected to contribute to this growth.

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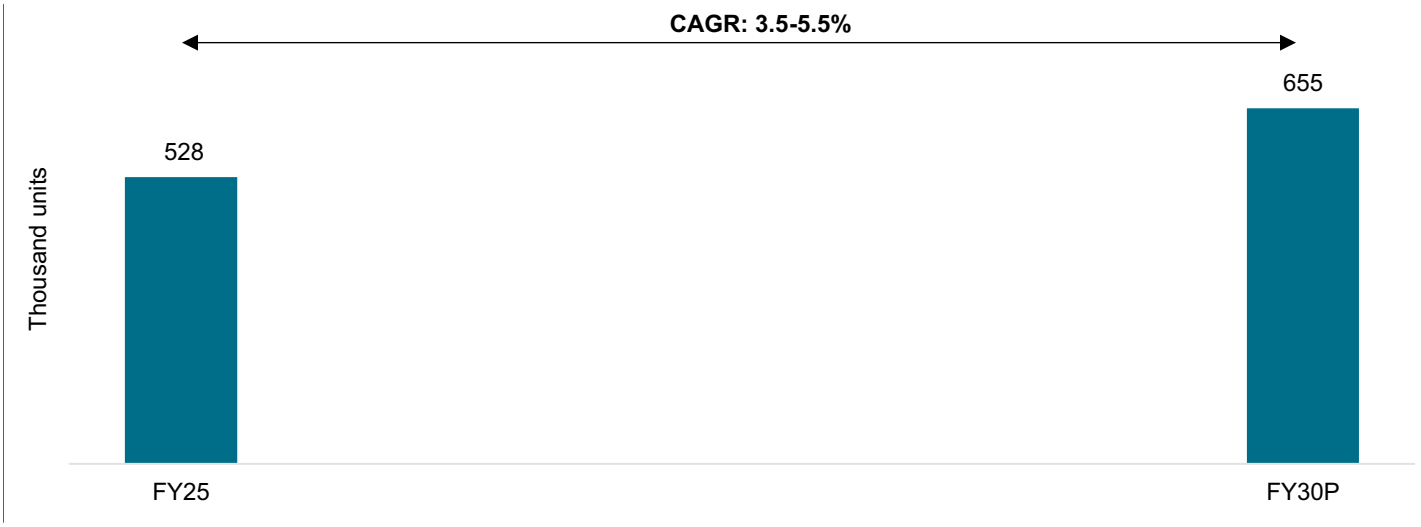
LCV outlook



Source: SIAM, Crisil Intelligence

LCVs are primarily used for last-mile transport and redistribution of commodities. Private final consumption expenditure (PFCE) is a good indicator of domestic consumption demand. 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 growth momentum and log a CAGR of 6.5-7.5% between fiscals 2025 and 2030, supporting growth of LCV segment.

Replacement demand

LCVs are typically replaced every 6-8 years, and vehicles purchased between fiscals 2011 and 2013 were due for replacement in fiscal 2019. Replacement demand was estimated to have been particularly high for the sub-one-tonne segment, given its robust sales between fiscals 2011 and 2013. This strategic replacement cycle contributed to stable LCV sales in fiscal 2019. It also prevented a major decline in sales over fiscals 2020-2023, of which the latter three years were impacted by the pandemic, with LCV sales at 81%, 125% and 137% of pre-Covid levels, respectively (vs MHCV sales at 65%, 174% and 209%, respectively). However, with the bulk of replacement demand actualised over fiscals 2021-2023, replacement sales were depressed in fiscal 2024, with some pick-up in fiscal 2025.

IMHCV segment outlook

The IMHCV segment's performance fluctuated but remained resilient in recent years. In fiscal 2025, its growth moderated, reflecting the impact of economic headwinds and supply-side challenges.

The segmental dynamics highlight a transition towards a more balanced fleet mix, with IMHCVs recovering and tippers maintaining steady demand. The sustained push for infrastructure development, increased logistics digitalisation and policy-driven fleet modernisation are expected to shape the segment-wise trends in the coming years.

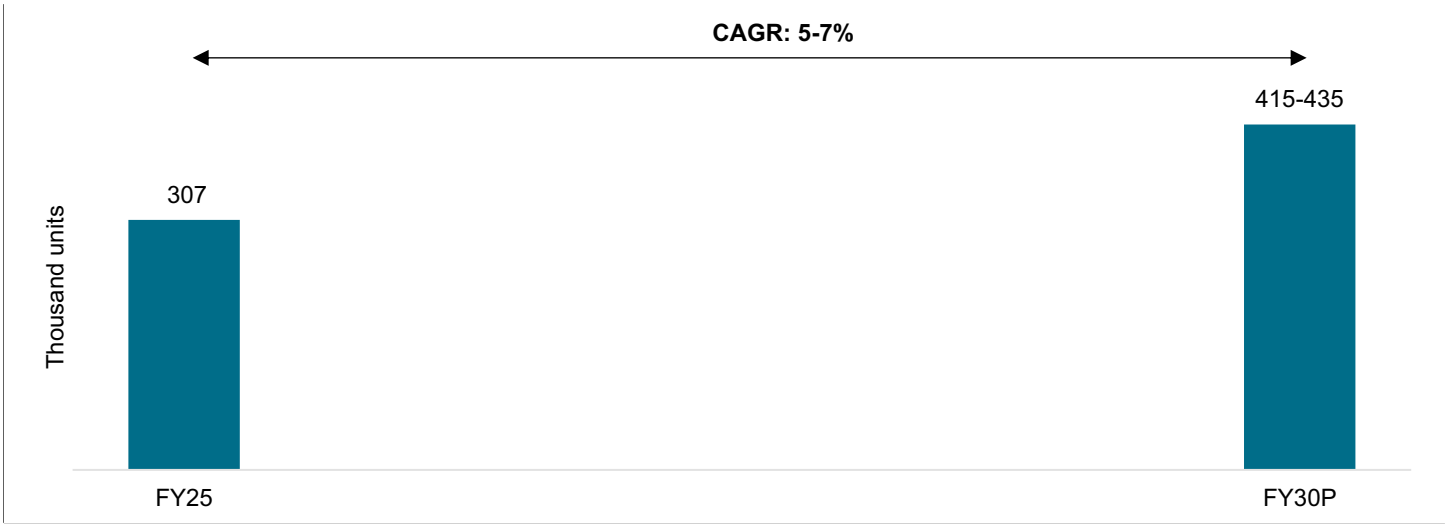
The IMHCV segment is expected to log a healthy CAGR of 5-7% between fiscals 2025 and 2030. It may witness a slowdown in fiscal 2026 due to short-term economic uncertainties and a potential dip in pent-up replacement demand. However, performance of MHCVs and tippers is likely to remain resilient, backed by continued infrastructure momentum.

Long-term IMHCV sales will be driven by several factors, including the country's improving industrial activity, consistent agricultural output, and the government's continued emphasis on infrastructure development. However, volume growth

may be limited due to efficiencies gained from the implementation of the Goods and Services Tax (GST), the development of better road infrastructure, and the commissioning of the dedicated freight corridor (DFC).

Over fiscals 2025-2030, industry GVA is expected to be robust, driven by the government's emphasis on "Make in India." Moreover, improvement in infrastructure and higher expected corporate expenditure are likely to support the capex cycle going forward. India's ambitious infrastructure development plans, including the Bharatmala Pariyojana and the Sagarmala Programme, are expected to drive CV demand, as the resulting increase in construction and logistics activities boosts demand for heavy and medium CVs.

IMHCV outlook



Source: SIAM, Crisil Intelligence

Growth in end-use industries

Key end-use segments and outlook		
Sectors	**Growth outlook (FY25-30)**	**Key aspects**
Coal	1-2%	Growth in coal-based power generation Demand from allied sectors such as cement and sponge iron
Steel	7-9%	Building and construction, the major demand creator in this segment
Cement	7.5-8.5%	Demand to be driven by rural housing/ affordable housing and commercialisation of Tier III/IV cities Infrastructure demand also plays an important factor
Port movement	2-6%	Iron ore exports to support growth, as global demand for steel improves. POL trade (imports), particularly in LPG, poised to rise
Road investment	8-12%	The NIP to drive infrastructure investments in roads and highways. Crisil Intelligence expects the Government of India to achieve 80-85% of its targeted investments
E-commerce	21-26%	The food, fashion and grocery segments to grow at a faster rate as penetration improves. E-retailers to focus on expansion in Tier I/II cities over this period

Source: Crisil Intelligence

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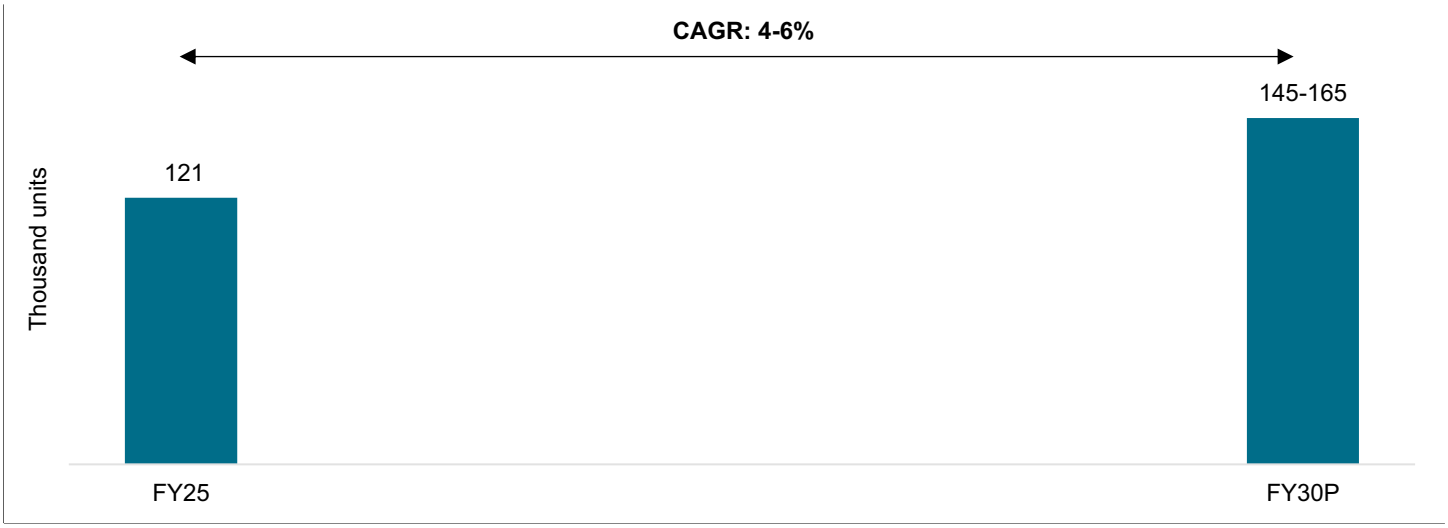
Bus segment outlook

The bus segment is expected to clock a moderate CAGR of 4-6% between fiscals 2025 and 2030, compared with a CAGR of 7% between fiscals 2020 and 2025. It is projected to expand from 121 thousand units in fiscal 2025 to 145-165 thousand units by fiscal 2030.

The segment's growth is expected to be gradual as STUs and private operators incrementally replace ageing fleets and respond to growing urban and intercity transportation needs. The segment may see further momentum through central and state-led procurement schemes, with a stronger push for cleaner public transport. However, due to slower penetration of e-buses outside STUs and higher acquisition costs, the segment's growth may remain modest compared with goods vehicles.

Bus outlook



Outlook on electrification

The government's continued push towards clean mobility through a combination of policy initiatives, financial incentives and regulatory support is set to play a pivotal role in accelerating the adoption of e-LCVs in India. Various measures, such as subsidies under the PM E-DRIVE scheme, lower GST rates, state-level incentives and tax benefits for EV buyers, are collectively making e-LCVs a more economically viable and attractive option for transporters and fleet operators.

As last-mile delivery and intra-city logistics continue to expand with the growth of e-commerce, there is a growing demand for cost-efficient, sustainable transport solutions. e-LCVs, with lower operating and maintenance costs compared with their ICE counterparts, are well-positioned to meet this demand. Additionally, the increasing availability of charging infrastructure and OEMs' growing focus on introducing competitive and reliable electric models are further contributing to market readiness.

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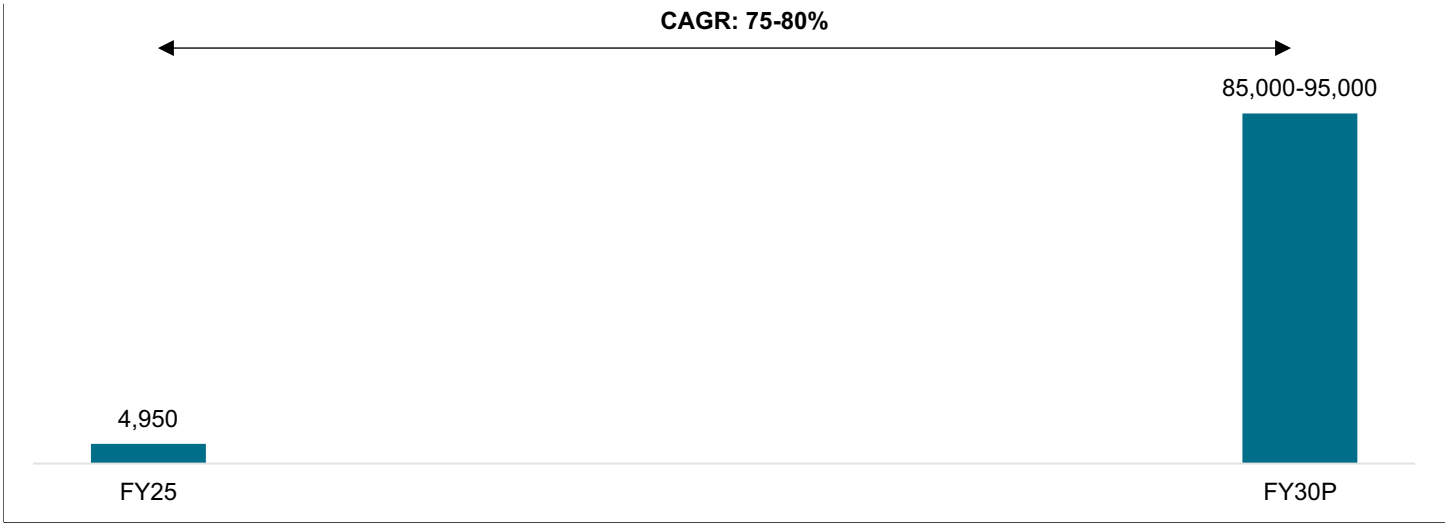
Outlook on domestic e-LCV volume



Source: Crisil Intelligence, VAHAN

These supportive dynamics are expected to drive strong growth in the e-LCV segment, with industry estimates indicating a robust CAGR over the next several years. By fiscal 2030, the annual volume of e-LCVs is anticipated to be 85 -95 thousand units. This marks a significant leap from the current base, underscoring the transformative potential of electrification in the CV space.

Demand drivers for electrification

- **Favourable TCO:** Despite higher upfront costs, e-LCVs offer significantly lower running and maintenance expenses due to fewer moving parts and lower energy costs. Over a vehicle's lifecycle, the TCO for e-LCVs is becoming increasingly favourable compared with ICE counterparts, especially for high-utilisation commercial applications
- **Advancements in battery technology:** Improved battery life, faster charging and falling battery costs are enhancing the practicality and affordability of e-LCVs
- **Regulatory push:** Emission norms: Stricter CO_2 emission and fuel economy norms (e.g., BS-VI in India, Euro 6 in Europe). Government incentives: Subsidies (such as FAME-II in India), tax breaks and exemptions on registration/road tax. Increasingly stringent emission norms and regulatory support for electric mobility continue to push OEMs and fleet operators towards cleaner alternatives
- **Replacement opportunity in ageing fleet base**: A large portion of the existing ICE LCV fleet is ageing and nearing replacement. This presents a critical window for electrification, especially as fleet operators become more aware of long-term cost benefits. Replacement cycles in commercial fleets also provide a structured and recurring demand pattern that can be targeted for EV penetration
- **Increased OEM presence**: Many mainstream players are planning to launch an EV offering that is expected to boost sales in the longer term. Growing investments in public and private charging infrastructure, battery swapping stations and better service networks are reducing operational friction for commercial EV adoption and encouraging OEMs to tap into the EV segment
- **Capacity expansion:** Most OEMs are expanding their EV capacity to address the expected rise in demand for EVs. Moreover, government push in the form of mandatory localisation and PLI schemes will provide additional support to capacity expansion

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- **Competitive pricing:** Battery is the primary contributor to the high EV prices. Through R&D, manufacturers are trying to lower the battery pricing while increasing the vehicle range. Companies are trying to achieve a golden mean between pricing and range. This improvement in the customer offering will provide an impetus to EV demand
- **Last-mile delivery boom:** Growth of e-commerce and hyperlocal deliveries (Amazon, Flipkart, BigBasket, Zomato, etc.) is fuelling demand for compact, efficient vehicles with low running costs. E-commerce, logistics and urban delivery companies are actively pursuing electrification targets to reduce operational costs and meet sustainability goals. Corporate ESG commitments and investor pressure are also accelerating the shift to greener last-mile delivery solutions
- **Urban pollution concerns and emission norms:** Cities are increasingly moving towards low-emission zones. Regulatory pressure and environmental concerns are pushing logistics providers to shift to cleaner transportation such as e-LCVs
- **Improving charging infrastructure:** Expansion of public and private EV charging stations, especially in urban and semi-urban areas, is making e-LCV adoption more viable

Electrification in buses

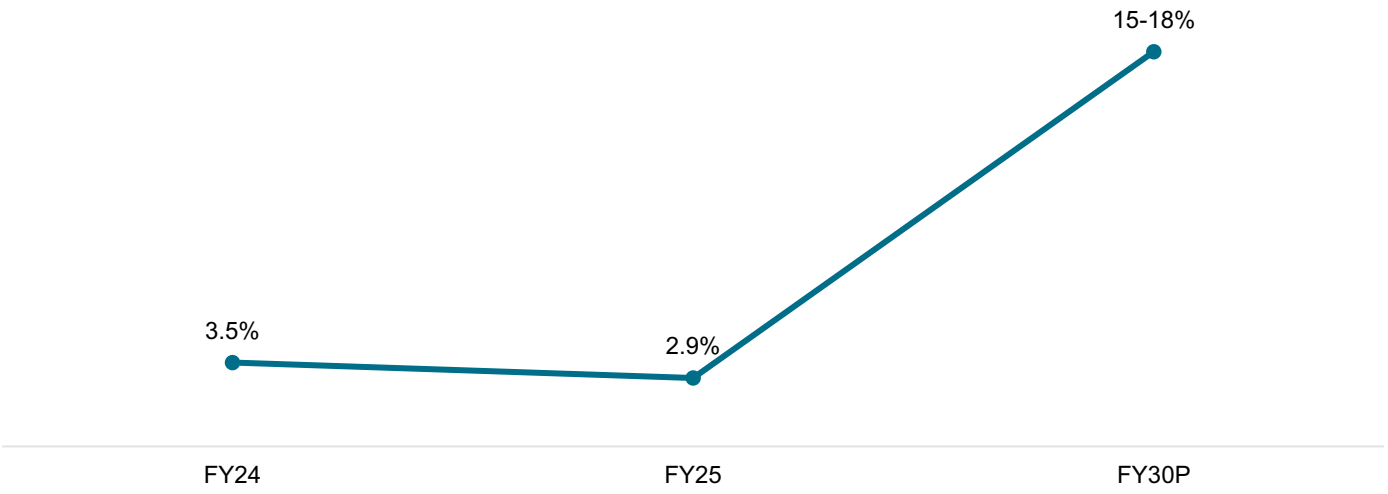
Electric bus registrations have surged in recent years owing to increasing adoption by STUs and government incentives. EV penetration gained some pace in fiscal 2020 and received a real boost in fiscal 2022, when it reached 3.8% of overall registrations. The momentum continued in fiscals 2024 (penetration: 3.5%) and 2025 (2.9%).

Due to the government policy support and focus on quicker adoption of EVs in public transport, there has been a significant increase in electric bus sales in the last couple of years. Buses with fixed routes and regular stops are well-suited for charging at pre-determined intervals and specific locations.

The price of an electric bus is considerably higher than that of a bus running on diesel. Thus, subsidy would be a key factor in driving EV adoption in STU buses. We expect a large share of STU intra-city buses to be electric by fiscal 2030.

EV penetration in buses is expected to reach 15-18% by fiscal 2030.

Outlook on EV penetration in buses



Source: Crisil Intelligence, VAHAN

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Exports

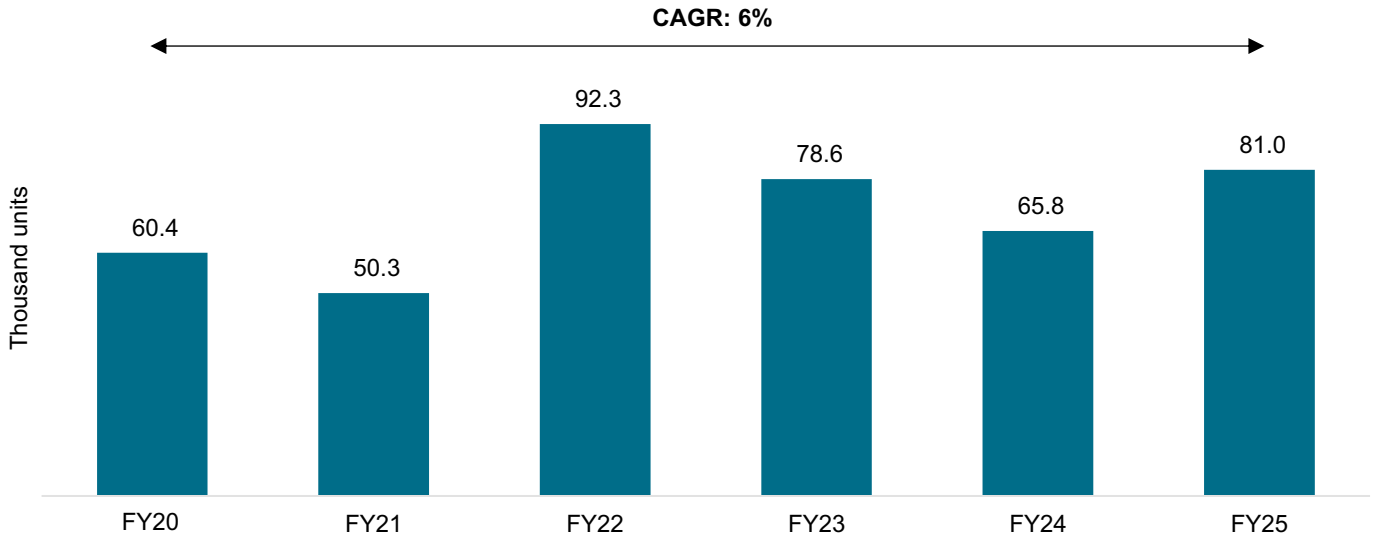
Exports, which form 7-8% of the overall CV industry, rose from 60 thousand units in fiscal 2020 to 81 thousand units in fiscal 2025, representing a CAGR of 6%. This growth was led by increasing demand for Indian CVs in emerging markets, strategic investment in localisation of products, and rising competitiveness of Indian OEMs on cost and quality parameters.

After consecutive drops in fiscals 2023 and 2024, off the high base of fiscal 2022, industry exports rose a healthy 23% in fiscal 2025. A sharp rise in exports of the cargo segment and some improvement in the macroeconomic scenario supported this healthy growth.

India primarily exports to developing regions such as the Middle East, Africa and Asia. Manufacturers are directing investments into expanding their presence from neighbouring countries such as Bangladesh, Nepal and Sri Lanka to Asia, Africa and the Middle East. Domestic players are also considering setting up assembly operations across multi ple markets. Also, going forward, new product line-ups and technology upgrades will allow domestic players to enter relatively advanced markets of Southeast Asia.

Industry exports are expected to rise 13-16% on-year this fiscal, with MHCV cargo growing at the fastest pace, followed by buses. The largest LCV cargo segment is expected to witness relatively slow growth from an already elevated base.

Trend in exports



Source: SIAM, Crisil Intelligence

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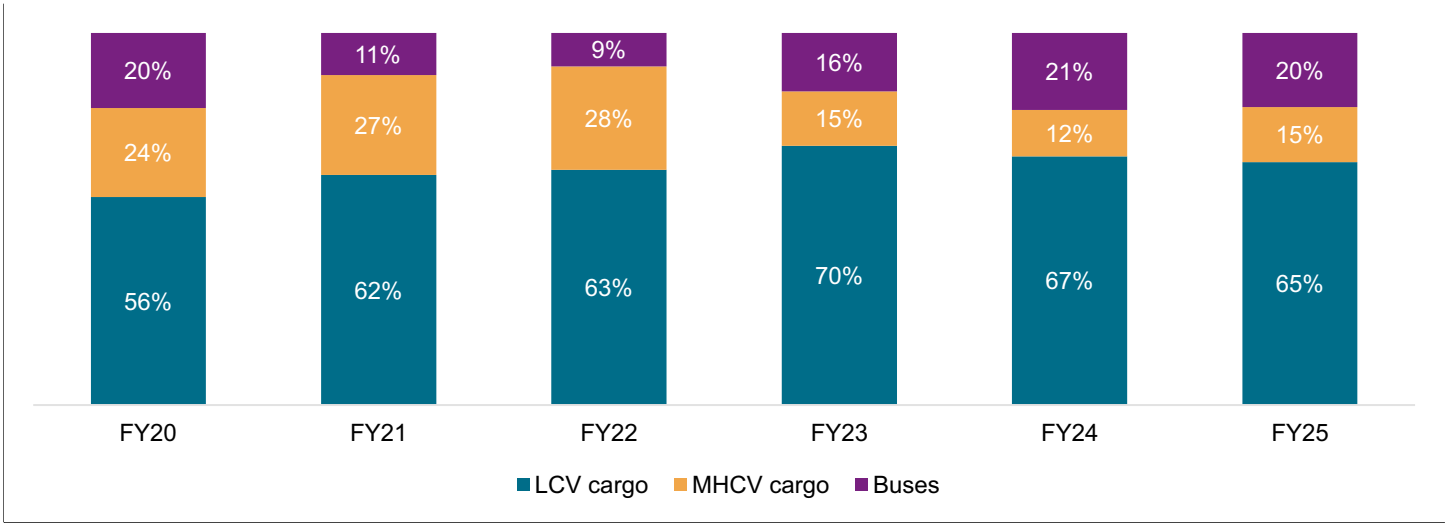
Segment-wise exports from India



Source: SIAM, Crisil Intelligence

Crisil Intelligence

Review of and outlook on the tractor industry

The current landscape

In recent years, the tractor industry in India has exhibited healthy growth, reflecting the significance of the agriculture sector in India and the mechanisation of farming practices.

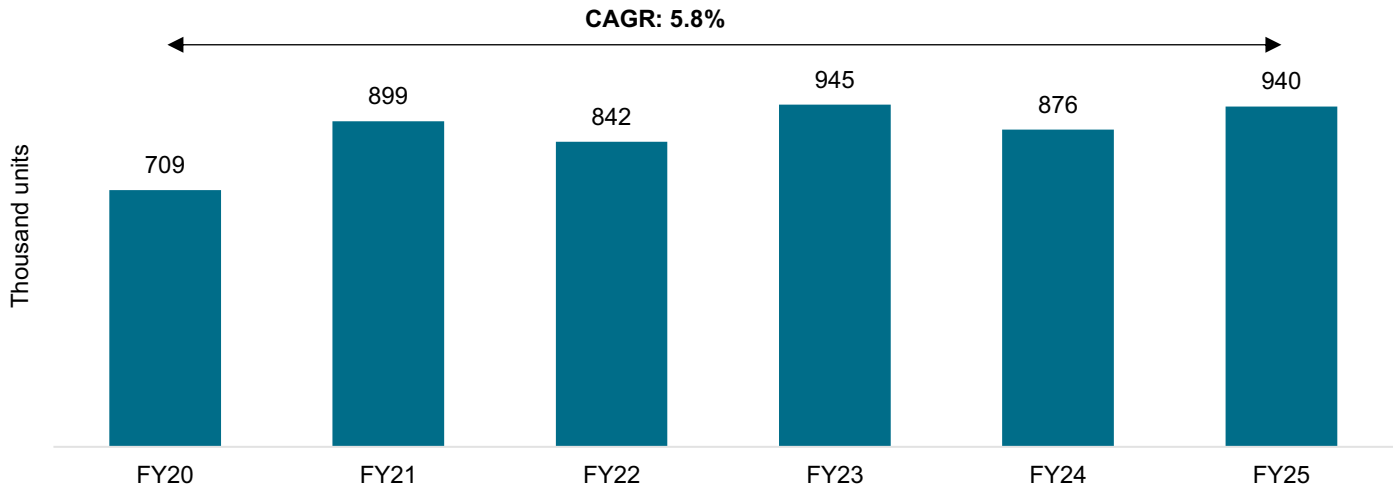
Domestic tractor sales surged to 940 thousand units in fiscal 2025 from 709 thousand units in fiscal 2020, signifying a 5.8% CAGR.

The growth trajectory can be attributed to various factors, including the government's focus on rural development and the promotion of agriculture, which has incentivised farmers to invest in modern farming equipment such as tractors. Additionally, technological advancements and innovative financing options have made tractors more accessible to a wider range of farmers, further driving sales.

The Covid-19 pandemic had a limited impact on the agriculture sector and tractor demand. In fiscal 2022, domestic tractor demand dropped 6.3% y-o-y after growing 26.9% in fiscal 2021. Price hikes by OEMs, higher inventory at dealerships, lower commercial demand, negative farmer sentiment owing to rising cultivation costs, and low fertiliser availability impacted sales during fiscal 2022.

In fiscal 2023, tractor sales grew 12.2% y-o-y to an all-time high of ~945 thousand units. Healthy crop prices, sound reservoir levels owing to above-normal monsoon, higher minimum support prices (MSPs) announced by the government and better rabi acreage, all led to positive farmer sentiment. Healthy festive demand because of various schemes and discounts supported the retail growth momentum. Commercial demand, however, remained rangebound in fiscal 2023 due to slower retail momentum in eastern states and a complete ban on sand mining. In recent years, governments in states such as Bihar, Jharkhand and Uttar Pradesh have clamped down on illegal sand mining, which has negatively impacted commercial demand for tractors.

Trend in domestic tractor sales



Source: Tractor Manufacturers Association (TMA), Crisil Intelligence

In fiscal 2024, domestic tractor sales fell 7.4% y-o-y to ~876 thousand units, because of lower reservoir levels and negative farmer sentiment. Uneven rainfall distribution, with monsoon being 6% below normal for the season, led to a slower pick-up in the retail market. Barring Northwest and Central India, all regions reported below-normal rainfall,

Crisil Intelligence

impacting tractor demand. Reservoir levels for the country remained low. Negative farmer sentiment also impacted festive demand, with sales in the festive months of September, October and November for fiscal 2024 being 6% lower on-year.

Erratic monsoon, lower reservoir levels and a decline in rabi acreage contributed to a 7.4% on-year decline in tractor sales in fiscal 2024.

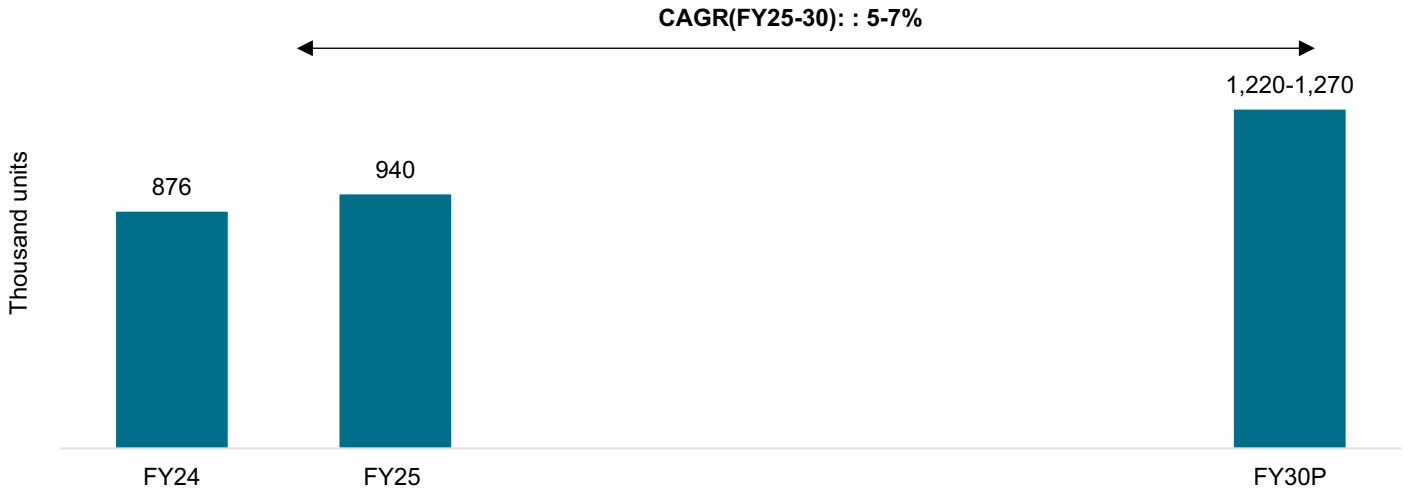
Last fiscal, with an above-normal monsoon season aiding farmer sentiment, domestic tractor sales grew 7.3% on-year to 940 thousand units. A healthy increase in volumes up for replacement supported growth in the fiscal. Favourable rainfall boosted kharif crop output, while higher reservoir levels enhanced rabi crop profitability. Government measures, including increased crop procurement and higher MSPs for the rabi season, boosted farmers' cash flows, thereby leading to a healthy retail momentum during the fiscal.

Our outlook on the domestic tractor industry

Crisil Intelligence expects domestic tractor sales to expand at a 5-7% CAGR over fiscals 2025-2030, factoring in one to two years of erratic monsoon and healthy rainfall in the remaining years. From fiscal 2020 to 2025, the industry registered a CAGR of 5.8%, off the low base of fiscal 2020, and healthy sales numbers over fiscals 2021-2025.

This fiscal, tractor demand is expected to grow 7-9% on-year, considering an above-average monsoon season as forecast by the India Meteorological Department (+3% departure at the end of July 2025) and stable agricultural conditions supported by replacement demand. The growth will be driven by healthy reservoir levels, higher farmer incomes from a strong rabi harvest, increased MSPs and an anticipated rise in government crop procurement. Additionally, sustained investment in rural infrastructure and mechanisation trends may provide further momentum to demand.

Domestic tractor sales projections



Note: P – Projected
Source: TMA, Crisil Intelligence

Domestic tractor sales are projected to grow up to fiscal 2030, driven by low tractor penetration (three tractors per 100-hectare area), the government's focus on improving farm incomes through various schemes, promotion of farm mechanisation, and investments to improve rural infrastructure. Continued replacement demand will also provide a boost to tractor sales over the long term.

Crisil Intelligence

The tractor industry is cyclical, and historical trends indicate it takes 4-5 quarters to recover from downturns. Thus, assuming one to two years of poor monsoons between fiscals 2025 and 2030, the tractor industry will log a CAGR of 5-7%.

Exports

Domestic segment dominates the tractor industry sales with 85-90% contribution. Exports accounted for about 10% of overall tractor sales in fiscal 2025. During the last 5 years (fiscal 2020-2025), domestic sales have clocked a slightly faster pace of 5.8% CAGR compared to exports which witnessed growth at 5.4% CAGR.

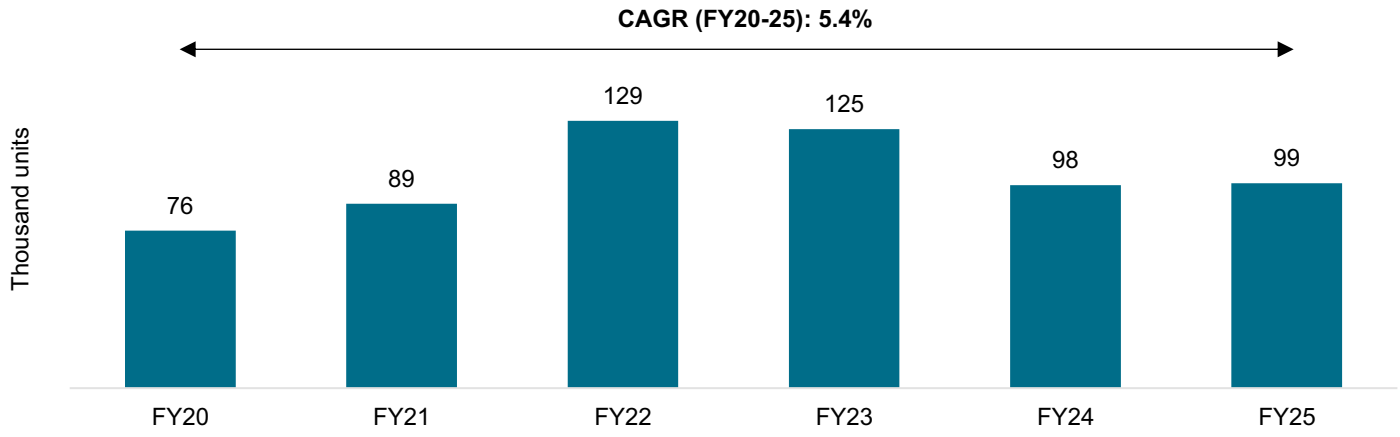
Exports rose a slower ~1% on-year in fiscal 2025 to 99 thousand units on a low base of fiscal 2024, which recorded a 21% on-year decline. Revival in demand from the US, Europe and Asia supported this growth, but it was not enough to get back to fiscal 2022 highs.

The fluctuations in export numbers can be attributed to factors such as changes in global demand and foreign exchange rates, and economic conditions in importing countries. The resurgence in exports in recent years suggests Indian tractor manufacturers have adapted to these challenges, improved product quality and expanded their global reach.

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 recent years.

This fiscal, tractor exports are projected to grow at a slightly faster pace of 1-4% on-year, on the low base of last fiscal. The US, Europe and Asia are likely to remain the focus regions.

Trend in tractor exports



Source: TMA, Crisil Intelligence

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Shaping India's Role in the Global SDV Revolution: Market Maturity, Opportunities, and the Road Ahead

By

Deloitte.

Shaping India's Role in the Global SDV Revolution: Market Maturity, Opportunites, and the Road Ahead

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Chapter 1. Maturity Level of the SDV Market

Global Software-Defined Vehicles (SDV) Market

The Global SDV market is projected to be USD 400 –600 billion in value by 2030, with penetrati n rising from 2.4% in 2021 to over 9 5% by 20 30, making nearly all new vehicles software-defined. AI, cloud, and OTA integration are driving faster product cycles and recurring revenue models. [i], [ii]

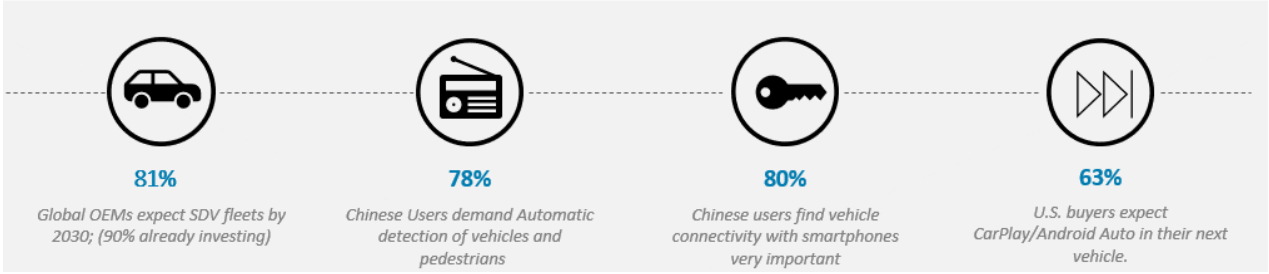
SDVs will account for more than 95% of new vehicles by 2030, creating USD 400–600 bn invalueby2030,with OEMsspending~USD3bnannuallyon software platforms,OTA,andcybersecurity.

As per our global study, out of the total spend on R&D annually, onethird of the budget is focused on software platorms, cybersecurity, and OTA updates. Centralized SDV strategies have delivered 23% R&D cost savings, while 80% of SDV leaders engaged in partnerships report 16% savings through collaboration in cybersecurity, autonomous driving, and OS development.

With penetratio set to exceed 9 5% by 20 30, investments made by OEM annually, and strong consumer willingness to pay in fast -growing markets like India and China, SDVs are emerging as the industry's primary driver of value creation and competitive advantage.

Consumer demand further strengthens this trajectory, with buyers increasingly valuing connectivty, safety, and personalized digital services as core features of new vehicles. This shii not only accelerates adoption but also validates SDVs as the future standard for mobility (Fig 1).

Fig 1: Consumer demand reinforces this trajectory:



Sources: Deloitte Research

India's SDV market

India's SDV market is projected to expand from USD 18.2 billion in 2025 to USD 69.5 billion by 2031, a CAGR of 24.9%, driven by structural, technological, and consumer shifts. India's mobility landscape is being reshaped by rapid urbanizati n and digital transformation.

By 2025, 35.8% of India's populati n will live in urban areas, a figure projected to reach 50% by 2050, driving concentrated demand in Tier II and Tier III cities as well as industrial hubs. Simultaneously, the expansion of digital public infrastructure—Aadhaar, UPI, account aggregators—together with the IndiaAI Mission's focus on AI infrastructure and talent, is creating a robust foundation for connected and intelligent vehicles.

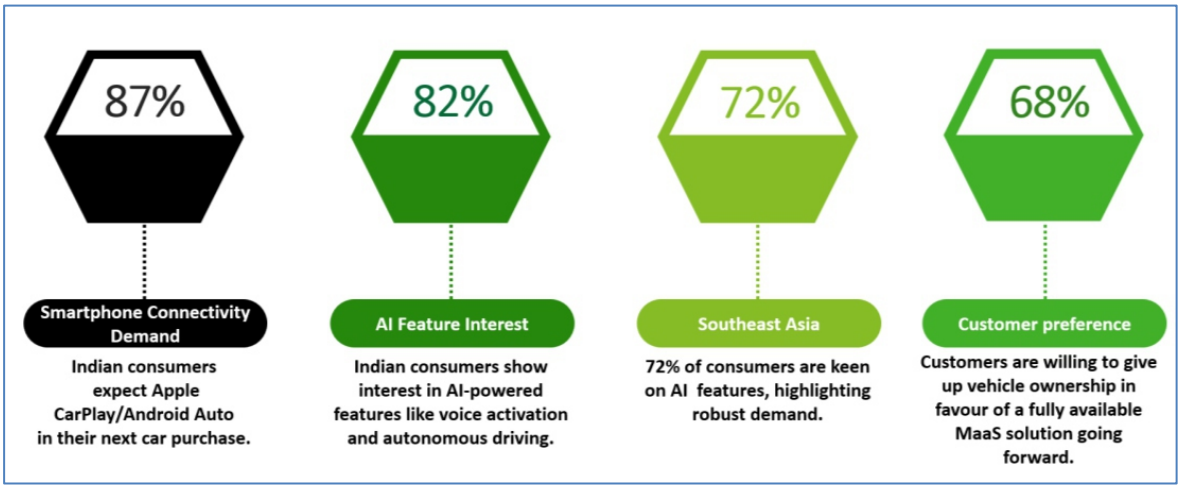
EV sales have surged from 50,000 units in 2016 to 2.1 million in 2024, a CAGR of 59.4% across segments. [iii] Two-thirds of Indian buyers are considering an EV for their next purch ase. [iv] Government initiatives such as PM E-Drive Scheme, Productio Linked Incennve (PLI) for advanced cells, and state EV policies are further catalysing adoption. Since EVs depend heavily on

sofware for energy management and predictive maintenance, rising EV penetrati n directly supports SDV readiness.

India's SDV market will grow from USD 18.2bn in 2025toUSD69.5 bnin 2031, CAGR 24.9%, driven by EVadoption , digitalinfrastructureandrising consumer demand for connected features.

Consumers are also becoming more receptive. Traditionally cost-sensitve, they are now open to mobility-as-a-service, subscripti n models, and digitally enabled ownership. [v] Strong interest in connected features, safety technologies, and personalised services signals a demand-driven push toward smarter, more sustainable mobility aligning with the supply -side enablers already in moti n. (Fig 2)

Fig 2: Indian consumer readiness



Source: Deloitte India GACS 2025

The quick expansion of the SDV market is being propelled by the convergence of multipe forces like electrification, connectivity, and advanced driver assistance systems (ADAS), along with growing consumer demand for personalized, sofware -driven mobility experiences.

Chapter 2. Sofware -Defined Vehicles: Architecture, Evoluuon, and Ecosystem Value Chain

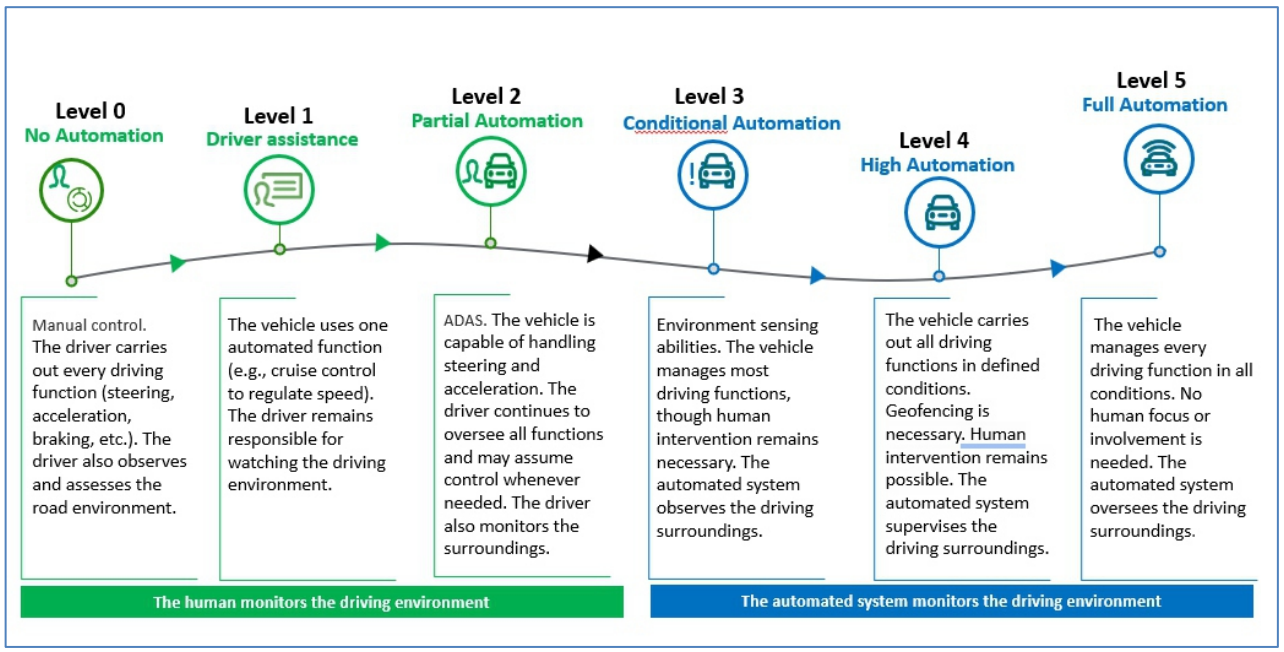
By integratng advanced domains powered by sensors, ECUs, connecti ity modules, and AI-driven sofware , SDVs transform vehicles into intelligent, connected ecosystems. These include:

- Driver assistance
- Powertrain control
- Infotainment
- OTA updates
- V2X communication, and
- Cybersecurity.

SDVs are evolving into intelligent, connected ecosystems progressing from basic connectivity to fully autonomous, monetizable platforms.

Their evoluti n can be mapped across levels from 0 to 5 (as shown in Fig 3), ranging from basic connectivity with limited software control to advanced platforms that enable OTA updates, features on demand, AI-driven autonomy, and continuous data monetization.

Fig 3: Self-driving technology phases and relevance for autonomous services.

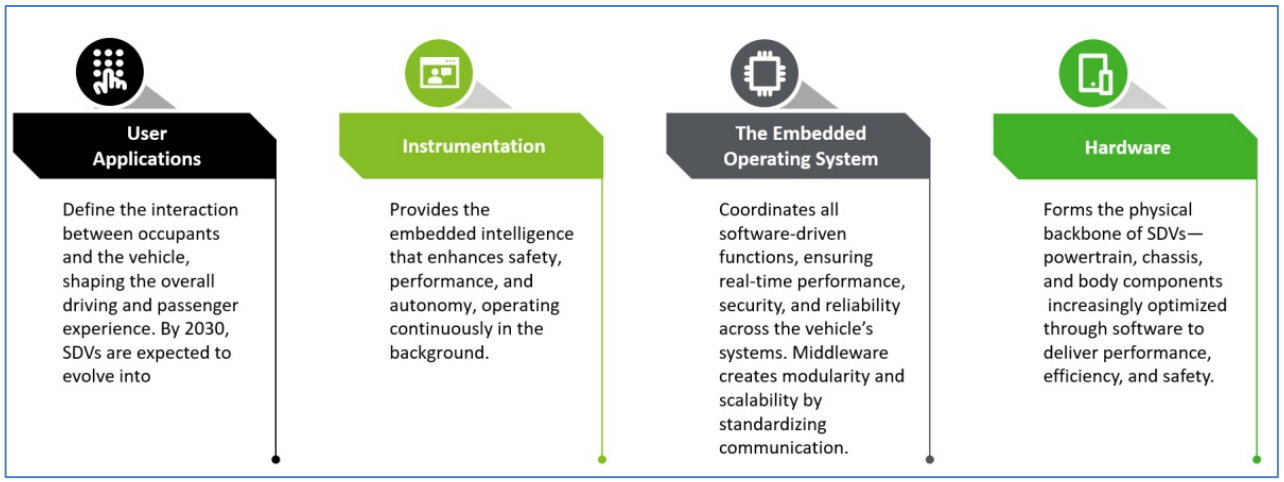


Source: Deloitte Research

The four pillars of SDV Architecture

SDVs are built on a layered architecture supported by four interdependent pillars, each with its specific function outlined below (Fig 4).

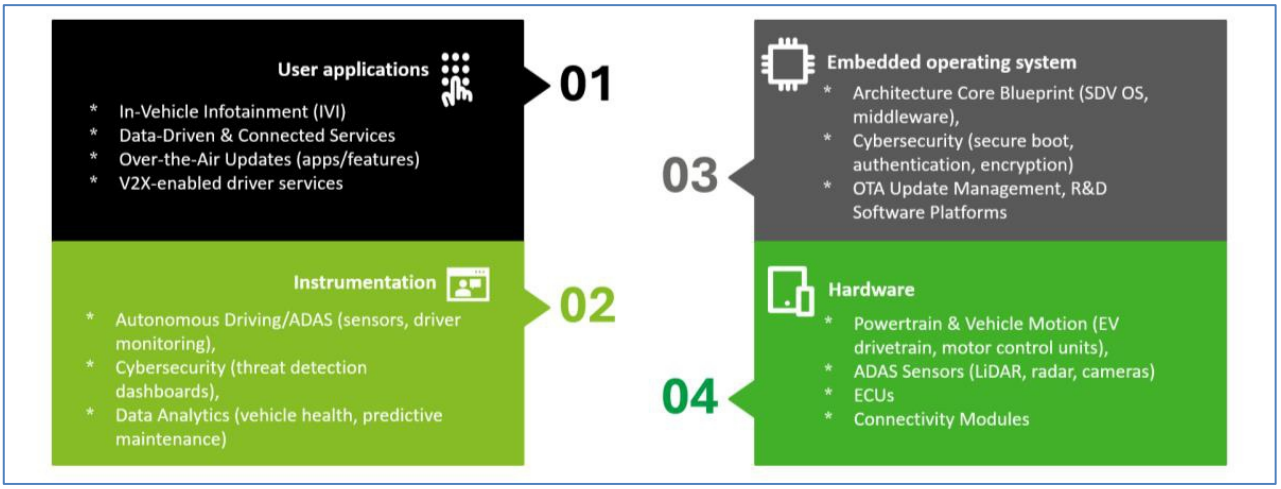
Fig 4: The Four Pillars of SDV Architecture



Source: Deloitte Research

The effectiveness of the SDV architecture depends on the integration of specific hardware and software elements within each pillar. A systematic mapping of components to these four interdependent pillars provides clarity on their functional roles and highlights the interconnections that enable the SDV ecosystem to operate cohesively (Fig 5).

Fig 5: Mapping of components with the pillars of SDVs

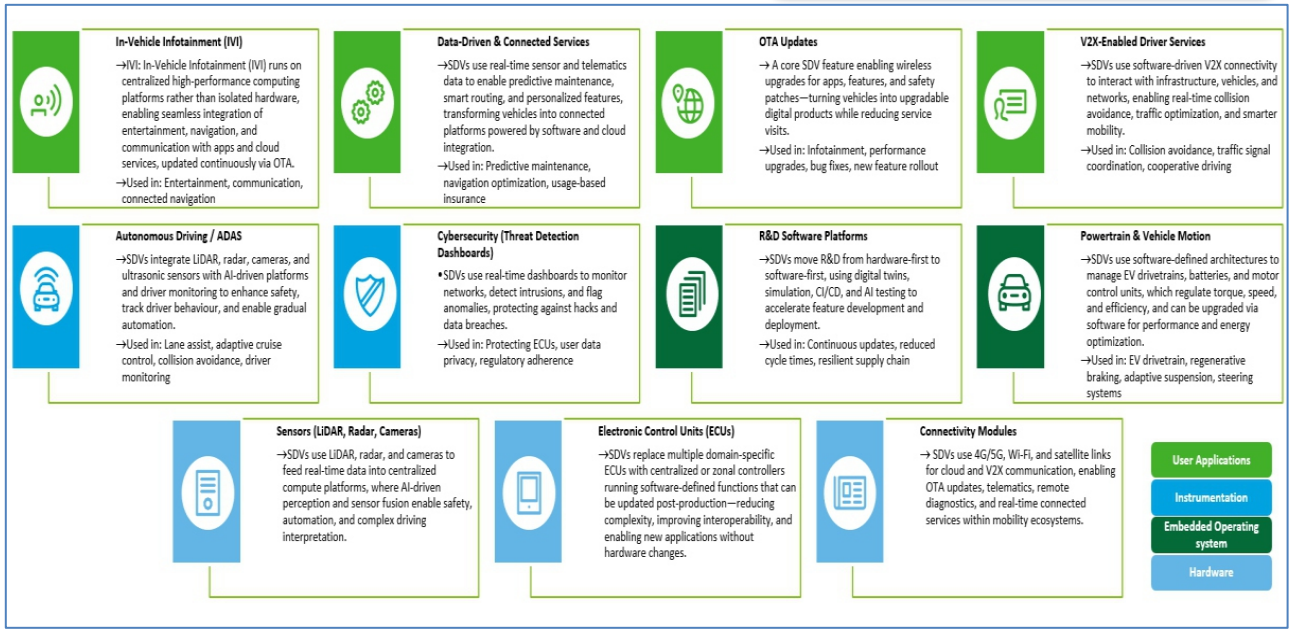


Source: Deloitte Research

Beyond their structural alignment with the four pillars, SDV components perform critical roles that ensure system reliability, security, and performance. Outlining these fu ncti nal roles provides deeper insight into how individual elements contribute to the overall capabilitiesof sofware -defined vehicles. (Fig 6)

SDVs are redefining cars as digital platforms, so players must build strength in software, data, and integration, not just hardware.

Fig 6: Functional Roles of SDV Components



Source: Deloitte Research

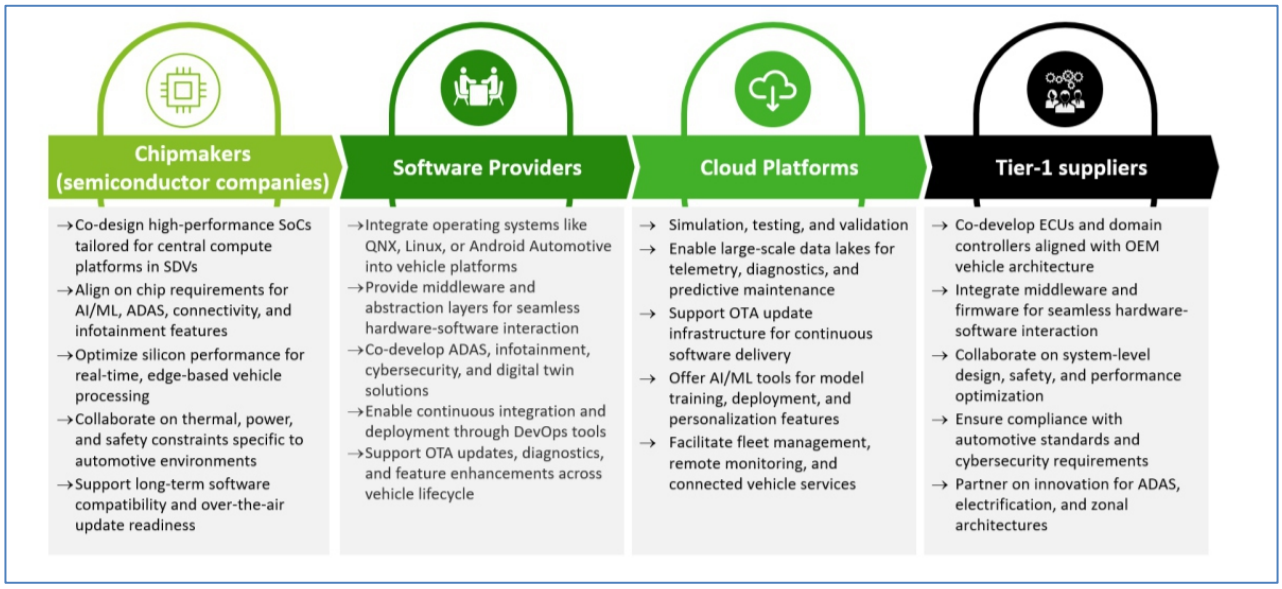
Stakeholders across the SDV ecosystem

The evolutio of SDVs and their layered architecture highlight the technological foundaatn enabling intelligence, autonomy, and continuous upgradability. Yet these advancements cannot be achieved in isolati n; their effececeness depends on an ecosystem where hardware, sofware, connectivity, and data work seamlessly together.

This makes the SDV value chain interconnected, with the chipmakers, sofware providers, cloud platforms, and Tier-1 suppliers playing complementary roles in designing semiconductors , developing operating systems, managing data, and integrating systems. Together, they enable the

delivery of intelligent, connected, and conti uously updatable vehicles. The following secctn outlines their contributions (Fig 7).

Fig 7: Key players of the SDV value chain



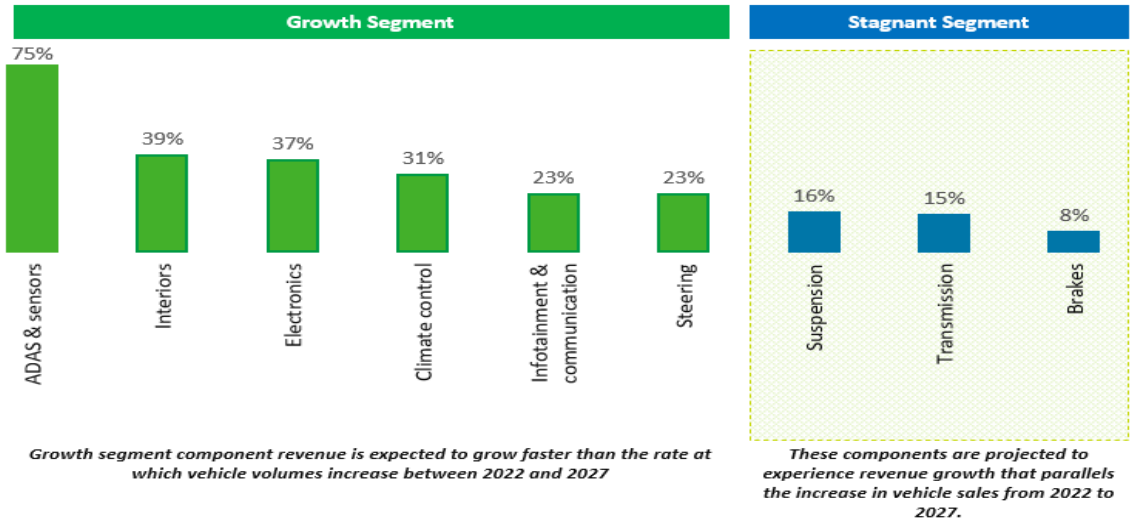
Source: Deloitte Research

Chapter 3. Shiftng SDV segments

While SDVs encompass a broad set of technologies across hardware, sofware, and applicaaons, not every component delivers the same strategic impact. For OEMs and suppliers, three areas — ADAS, Cybersecurity, and Subscripti n Models—are emerging as high-value growth segments and as domains of current relevance

In Deloitte's analysis of nearly 300 global automotive suppliers, ADAS are emerging as one of the fastest-growing segments (Fig 8). [vi] The global ADAS market is forecast to grow from USD 38.5 billion to USD 68.7 billion by 2030, at a CAGR of 12.3%.

Fig 8: SDV component growth segment (2022-2027)



Source: Deloitte Research

1) ADAS

In SDVs, ADAS functio s are centrally orchestrated through high-speed in -vehicle networks and domain controllers , enabling automakers to continuously refine features via sofware updates. This “sofware -first” approach enhances safety and convenience, allowing errors or new risks to be addressed through software patches rather than costly hardware recalls.

In India, v ehicles are also becoming increasingly electronics-intensive as demand for safety and sofware -driven features rises. From a small base today, India’s ADAS market is projected to grow at over 18.3% annually, with the country’s share in the global market expected to rise toward 10% by 2030.

Profit pools are shifting toward ADAS, subscription models and cybersecurity so India’s auto ecosystem must accelerate R&D and localization to capture value.

In late 2024, IESA and ELCIA launched a Centre of Excellence for sensors to localize production, while some platorms are connecctinOEMs with ADAS/S/sware innovators. Regulatory mandates, such as MoRTH’s ADAS requirements post-2026, alongside testng infrastructure like ARAI’s 18 -acre ADAS facility near Pune and Bharat NCAP 2.0 evaluations, are further driving adoption and investment.

For Indian suppliers, the ADAS opportunity extends beyond components to services such as calibrati n, validation, and software integration. Key strategies include:

Invest in R&D and Certification: Build expertisein electronics and AI/vision systems, and secure global certifications through collaboration with academia and government labs.
Localize and Integrate: Design ADAS for Indian conditio s and work with OEMs to integrate sensors, ECUs, and sofware into end -to-end solutions, leveraging industry hubs like the IESA/ELCIA sensor consortium.

Leverage Policy and Partnerships: Use PLI and ‘Make in India’ incentives to scale production and form global tech partnerships.
Expand Exports and Niches: Target emerging markets in Africa, Southeast Asia, and LatinAmerica where Indian ADAS soluuti s can solve similar road safety challenges, positioning India as a global ADAS supplier.

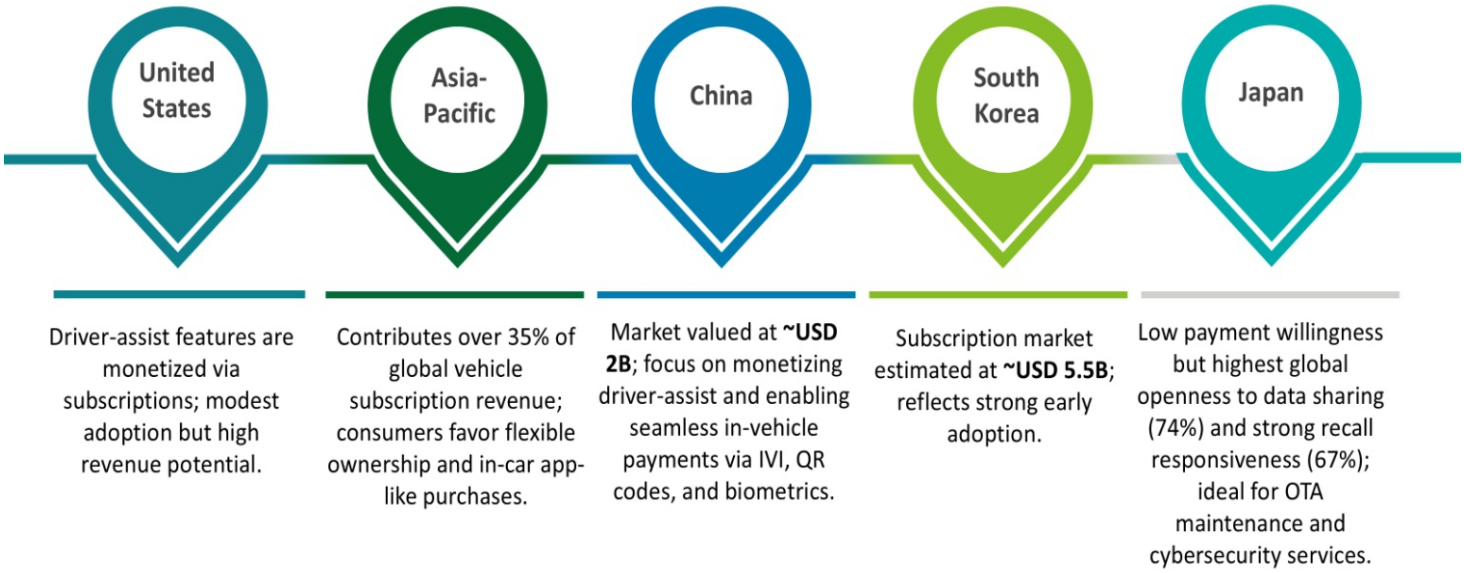
2) Subscription models

Traditionally, OEMs relied on one-time vehicle sales, with limited revenue from after-sales parts and maintenance a model that was volume -driven and highly sensitive to economic cycles. In contrast, the rise of SDVs is shifting the industry toward recurring revenue streams that extend across the vehicle's lifecycle. However, the revenue will likely be shared by all key players in the SDV value chain

Subscriptions features -on-demand, connected service bundles, predictive maintenance, and usage-based insurance are creatin more stable, higher -margin income while deepening customer engagement well beyond the initialsale. Tier-1 suppliers enable centralized compute, AI-driven percepton, predictive safety, and energy management — delivered via subscription/pay-per-use to keep vehicles "evergreen" and preserve residual value.

This transiti n plays out differently across markets, as consumer preferences shape monetiaatn models. In some reg ions, driver-assist features are offered via subscriptions with strong revenue potential, while others favo ur flexible ownership and app-like in-car purchases. Emerging ecosystems around in-vehicle payments further expand possibilities. At the same time, varying willingness to pay, openness to data sharing, and responsiveness to updates determine which services gain traction first. (Fig 9)

Fig 9: Regional models of Adopti n



Sources: Deloite Research

Domesti OEMs are embedding SDV features in both EVs and ICEs, while Indian engineering firms are exporting expertise in chip-to-cloud, autonomous platforms, and digital cockpits. This is enabling software subscriptions, feature unlocks, and services like usage-based insurance and predictive maintenance.

Subscriptionsnow span navigaatn, geo -fencing, health monitoring, emergency alerts, and digital in-car payments—often free initially, then paid. UPI and wallet integration give India a unique edge, aligning mobility with its digital payments ecosystem.

However, while in India 46% of users are willing to try free trials, only about 33% convert to paid subscriptions, underscoring the high degree of price sensitivity in the market. Younger buyers are more open to micro-services, such as city parking packs or short-term feature unlocks, pointing toward a selective but evolving appetite for software-enabled mobility. This suggests that the monetization opportunity for OEMs is likely to lie in flexible, smaller-scale services that can match the diverse spending paterns of Indian consumers.

After-sales service: In the SDV value chain, the after-sales segment is expanding far beyond traditi nal maintenance into high-margin, recurring revenue streams. OEMs and suppliers can now monetizevehicles post -purchase through subscripton -based features (e.g., advanced ADAS, infotainment, comfort packages), "XaaS" models such as vehicle-as-a-service or batery -as-a-service, and fleet management soluutionoffering predicdie maintenance, telemati s, and operaational opt zaiza . Digital services ranging from OTA updates to data-driven insurance and in-vehicle commerce—create contin ous engagement and lifeti e value. This shii posisi ns aser -sales not just as support, but as a strategic growth engine in the SDV ecosystem.

3) Cybersecurity

Cybersecurity is emerging as a cornerstone of the SDV ecosystem, as connectivty, OTA updates, and complex software stacks multiply potential vulnerabilities. With millions of lines of code and continuous data exchange across vehicles, clouds, and infrastr ucture, SDVs face risks ranging from breaches and ransomware to remote hijacking. Global frameworks like UNECE WP.29 (R155/R156) and ISO/SAE 21434 make cybersecurity a regulatory mandate, pushing OEMs and suppliers to adopt structured processes such as Threat Analysis and Risk Assessment (TARA), penetration testing, and continuous threat monitoring. For OEMs, robust cybersecurity ensures not only compliance but also consumer trust, safeguarding emerging revenue models like OTA upgrades, fleet services, and subscripti ns. For component suppliers, embedding security -by-design into ECUs, ADAS modules, and infotainment systems offers a pathway to move up the value chain, positioning themselves as strategic partners. Ultimately, cybersecurity is no longer just a defensive necessity—it is a lever for resilience, differentiation, and long-term monetiaatn in the SDV era.

Chapter 4: From Parts to Platforms: Unlocking opportunites for Indian Auto Component Suppliers in the SDV Era

1. OEMs Evolving into Software Platorm Orchestrators

Global automotive OEMs are moving beyond being vehicle manufacturers to becoming software platform orchestrators, like how smartphone ecosystems operate. Vehicles are no longer judged only on reliability and safety but on their ability to deliver personalized and connected experiences. To achieve this, OEMs are investng heavily in centralized electronic architectures, proprietary operating systems, and OTA service delivery.

Automakers are evolving into platform orchestrators, which means suppliers must move up the value chain from hardware to integrated hardware–software solutions.

This evolution changes what OEMs traditionally expect from suppliers. Tier 1 suppliers must provide integrated hardware–sofware plaaorms, domain controllers and advanced electronics. While Tier 2 suppliers are being pushed to strengthen their competence in semiconductors, sensors, and embedded software.

For Indian suppliers, this shift means moving beyond their traditional role as cost-efficient hardware providers. For example, leading suppliers in India have entered partnerships to develop EV powertrain solutions and connected mobility offerings. Other suppliers are investing in advanced electronics, cockpit modules, vehicle software, connectivity, Motor Control Units (MCUs) and cloud-enabled platorms. These moves underline that Indian component players must develop capabilities in embedded software, electronics design, system integration, and cybersecurity to co-create value with OEMs.

Embedding early into OEM digital platforms lets suppliers shape future mobility and capture outsized value.

2. Challenges in the Shift to SDVs

Globally, the SDV market is consolidating, with 3–5 dominant software platforms expected to emerge, similar to smartphone operating systems. At the same time, regulatory requirements around safety and cybersecurity are becoming more stringent across regions. Cyber risks also remain a concern, as modern vehicles rely on hundreds of sofware modules and are increasingly exposed to vulnerabilites through third-party code.

In India, the transition is far more complex. The supplier ecosystem is fragmented, and R&D on software capacity remains limited. Acute talent shortages in AI, cloud, and embedded systems slow adoption, while high transformaation costs, from testng infrastructure to digital plaaorms, add to the burden.

Indian OEMs and suppliers face cultural and structural barriers. Traditional hardware-focused R&D cycles are misaligned with continuous soware updates, and many suppliers remain dependent on mechanical capabilities Without investment in digital engineering and plaaorm integration, they risk losing ground to global peers that are already scaling sofware-first offerings.

3. Regulatory complexity must be addressed

As sofware and AI move to the forefront of automoove innovavon, regulatory landscapes are rapidly evolving. Automakers now face a fragmented web of global requirements spanning safety, sustainability, privacy, cybersecurity, and data protection. While eventual harmonization of these frameworks is likely, today's reality is one of shifing compliance targets that demand constant investment and vigilance.

Amid this complexity, regulators are zeroing in on two criti al areas: cybersecurity and soware update management. Global frameworks such as UNECE R155/R156 and ISO/SAE 21434 are emerging as the twin pillars of SDV compliance, defining both what must be achieved and how it should be engineered.

UNECE: The UNECE R155 (Cybersecurity and Cyber Security Management System [CSMS] and R156 (Sofware Updates and So ware Update Management Systems [SUMS]) regulalons published by Global Forum for Harmonization of Vehicle Regulations, though not yet mandatory in India, are becoming benchmarks for global SDV readiness and will inevitably influence Indian OEMs and auto -component suppliers. [vii, viii] Compliance requires OEMs to establish certi ed cybersecurity management systems, secure ECUs and telematcs against evolving threats, and ensure traceable, OTA sofware update mechanisms throughout the vehicle lifecycle.

For auto -component suppliers, thi s means building "security-by-design" into hardware and sofware, maintaining SBOMs (soware bills of materials), and suppoportisafe update/rollback features. As Indian vehicles increasingly target export markets and align with global SDV ecosystems, ear ly adoption of R155/R156 practices will be critical for competitiveness, supplier integration, and trust in connected and autonomous mobility.

ISO 21434: Untl ISO/SAE 21434:2021, auttomote cybersecurity was managed through fragmented frameworks such as ISO/IEC 27001, ISO 26262, and company playbooks, leaving gaps. [ix] ISO/SAE 21434 standardized a risk-based, end-to-end process across concept, development, production, operation, and decommissioning, replacing SAE J3061.

Globally, it serves as the engineeri ng "how" beneath regulatory "what," supporti g UNECE R155/R156 in Europe where compliance is mandatory for type approval.[x] In the U.S., though self-certification remains, regulators and Auto-ISAC best practces steer industry alignment to ISO 21434.[xi] [xii]

India is also moving from voluntary adoption to regulation through AIS-189 (CSMS) and AIS-190 (SUMS), both adapted from UN R155/R156 . Currently in draft stage, these regulations are expected to be enforced starting 2027, initially for new vehicle models and gradually extending to all vehicles in production. [xiii] The industry faces rising cyber threats such as network tampering, GPS spoofing, and remote hijacking, prompting adoption of IDS/IPS systems and VSOCs for real-time m nitoring. Cybersecurity is thus shifting from a technical differentiator to a regulatory and consumer trust requirement.

Key Takeaways for Indian OEMs and Auto-Component Players

- Early adoption of ISO 21434 ensures readiness for AIS -189/190 while avoiding costly rework later.
- OEMs must institutionalize processes like TARA (Threat Analysis and Risk Assessment), supplier cascading, and contnuous monitoring.
- Tier-1 and Tier -2 suppliers should embed "security by design" into hardware/software and prepare audit-ready evidence.
- Compliance strengthens domestic homologation and credibility in export markets, where cybersecurity is already mandatory.

Treating cybersecurity as integral to safety—on par with airbags or ABS —will be essential for building consumer trust in India's SDV ecosystem.

DPDP Rules: India's Draft Digital Personal Data Protection Rules 2025 will have significant implicatio s for OEMs and auto-component suppliers building SDVs. With stringent requirements on consent, data minimizatio , and breach repoortin OEMs must redesign in -vehicle and app-based consent flows, ensure clear nootes for data such as locacan, biometrics, and driving behaviour, and provide easy revocation options. Auto-component suppliers handling telematcs, ECUs, and connected systems will need to strengthen security, enable audit trails, and align contracts with DPDP obligations. Potential data localization and cross-border restrictions may also reshape cloud and analytics strategies, while larger players classified as Significant Data Fiduciaries will face mandatory audits and algorithm governance. Overall, compliance will demand ti hter data governance, stronger security engineering, and closer collaboraatn across the automotive value chain.

It is important that the organizatons start the compliance journey focusing on areas like restructuring of teams to manage additonal responsibiliies, conduct reassessment to ensure compliance of the draf rules and update technology security measures. Each data fiduciary should view the compliance journey through the lens of their own company's specific needs.

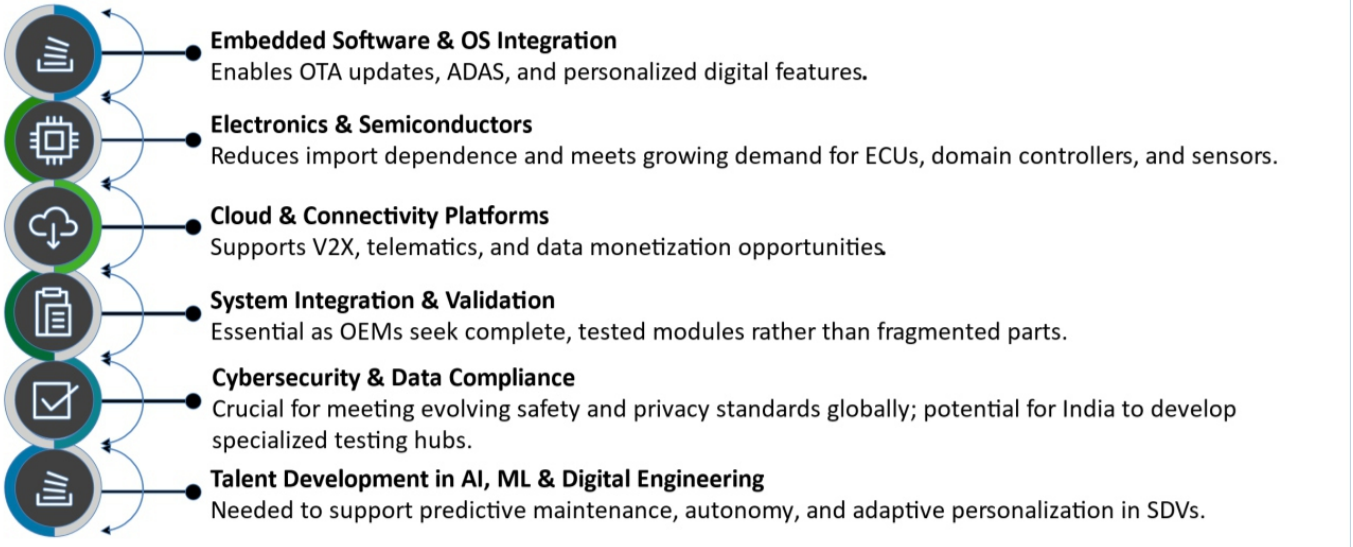
The future of mobility is about integrating both hardware and sofware . Success will depend on embracing sofware -defined architectures, harnessing AI-driven innovation, and preparing for regulatory convergence. While the road ahead is complex, those who act decisively to build resilient, sofware -centric organizations will be best positioned to thrive in the next era of mobility.

Cybersecurity and software update management are fast becoming the cornerstones of trust and competitiveness in software-defined vehicles.

4. Implications for Indian Component Manufacturers

For Indian auto component manufacturers, SDVs are both a risk and an opportunity. Companies that continue to operate solely as part suppliers risk losing relevance, as value creation increasingly shifs toward sooware and services. The opportunity lies in transitioning into integrated hardware–sofware sollut n providers, aligning with OEM roadmaps and global regulatio s.

Fig 10: Key opportunities for Indian Suppliers



Source: Deloitte Research

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[i] https://www.deloite.com/us/en/Industries/consumer/about/automoove -software-trends.html

[ii] https://www.deloite.com/us/en/Industries/consumer/arrcles/soso are -defined-vehicles-global-manufacturer-readiness-survey.html

[iii] https://www.niti.gov.in/sites/defa ult/files/2025-08/Electric-Vehicles-WEB-LOW-Report.pdf

[iv] https://www.deloite.com/in/en/Industries/automoove/perspeceves/global -automotve -consumer-study.html

[v] https://www.deloite.com/in/en/Industries/automoove/perspeceves/global -automotve -consumer-study.html

[vi] https://www.deloite.com/us/en/Industries/automoove/aracles/global -automotve -supplier-study.html

[vii] https://unece.org/transport/documents/2 s021/03/standards/un -regulation-no-155-cyber-security-and-cyber-security

[viii] https://unece.org/transport/documents/2021/03/standards/un -regulation-no-156-software-update-and-software-update

[ix] https://www.iso.org/standard/70918.html

[x] https://unece.org/sustainable-development/press/three-landmark-un-vehicle-regulations-enter-force

htt s://www.vehicle -certficacon -agency.gov.uk/connected-and-automated-vehicles/cyber-security-and-software-updatng

[xi] https://www.nhtsa.gov/sites/nhtsa.gov/files/2022-09/cybersecurity-best-practces -safety-modern-vehicles-2022-pre-final-tag_0_0.pdf https://www.federalregister.gov/documents/2022/09/09/2022-19507/cybersecurity-best-practces -for-the-safety-of-modern-vehicles https://www.federalregister.gov/documents/2022/09/09/2022 -19507/cybersecurity-best-practces -for-the-safety-of-modern-vehicles

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Strategic Diversification: Unlocking New Revenue Horizons for Automotive Leaders

By

EY Parthenon

Shape the future with confidence

Strategic diversification: Unlocking new revenue horizons for automotive leaders



EY Parthenon
Shape the future with confidence

Foreword

India's automotive component industry has played a defining role in the country's rise as a global manufacturing and mobility hub. It has enabled value creation across the entire automotive ecosystem—from original equipment manufacturers (OEMs) and vehicle platforms to aftermarket services and exports. Today, however, the industry stands at the crossroads of a fundamental transformation.

Recent tariff tensions, raw material supply concerns and geopolitical developments—from trade realignments in the West to supply risks from the Middle East and East Asia—have added new layers of complexity to already stressed value chains. For auto component manufacturers, both the nature of risk and the shape of opportunity are being redefined.

In such an environment, diversification is no longer a distant strategic option—it is a current-day business imperative for a more resilient future. The ability to spread risk, tap into new revenue pools and adapt to a broader range of customers and platforms is becoming critical to long-term relevance and resilience. Diversification, in this sense, is not about doing more—it is about doing differently and doing so with intent.

EY has developed the thought leadership titled 'Strategic diversification: Unlocking new revenue horizons for automotive leaders' to serve as a guide for component manufacturers navigating this moment of transition. It is based on our experience in the sector, extensive engagement with industry stakeholders and a deep dive into performance data across specialist and diversified firms.

The report outlines various aspects of diversification and the directions it can take—across capabilities, geographies, customer channels, industries and vehicle platforms—and explores both the risks and rewards that come with such choices. Diversification rarely exists in isolation; certain types of diversification appear to reinforce others. About 91% of all companies that are capability diversified are also powertrain diversified, suggesting that capability diversification allows companies to improve their risk profile across other dimensions as well.

This paper will enable leadership teams to reflect on where their organizations stand today and what kind of choices are needed to build for tomorrow. Whether it is building a new capability, tapping into an adjacent industry or reaching customers more directly, the imperative is to act early, act deliberately and act in alignment with your long-term strategic goals.

We remain committed to working with India's auto component leaders in unlocking this next phase of sustainable and resilient growth.



Som Kapoor
Partner, Future of Mobility Leader
EY Parthenon



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Chapter 5: Getting it right: Best practices for diversifying effectively

Executive summary

The Indian auto component sector is navigating a period of unprecedented change. From evolving powertrain technologies and policy reforms to supply chain rebalancing and shifting customer expectations, the landscape is being redrawn at a rapid pace. In this environment, diversification is no longer a growth lever; it has become a strategic necessity.

India's auto component market has grown significantly, reaching approximately US$80 billion in FY25, with exports touching US$22.9 billion[1]. However, this growth is occurring amidst rising volatility. Electric vehicle (EV) adoption is accelerating, legacy internal combustion engine (ICE) platforms are under pressure and supply chain disruptions—such as rare-earth material shortages—are becoming more frequent. Original equipment manufacturers (OEMs) are consolidating their vendor bases and demanding more integrated, tech-enabled solutions. Companies that remain narrowly focused on single customers, products or geographies risk obsolescence.

Diversification has emerged as the critical hedge.

It enables companies to spread risk, future-proof revenue and unlock new value pools. This paper presents five key diversification dimensions for component manufacturers:

1. Capability: Broadening technical expertise to avoid obsolescence and increase share of business per vehicle.
2. Powertrain: Catering to ICE, CNG, hybrid, and new energy vehicle (NEV) technologies, including powertrain-agnostic products.
3. Geography: Reducing dependence on domestic demand cycles and minimizing concentration in specific markets.
4. Industry: **Serving adjacent sectors like railways or construction equipment.**
5. Customer or channel: Expanding beyond traditional channels such as OEM and aftermarket to fleet, direct-to-consumer (D2C), e-commerce etc.

Each dimension mitigates a specific risk and/or adds a certain value. Capability and powertrain diversification drive high growth by tapping into emerging technologies and platforms. Geographic, industry and customer or channel diversification provide stability by shielding organizations from concentrated shocks.

To understand this better, we took a closer look at over 50 prominent automotive component companies in India. These companies were selected for analysis due to their significant market presence, innovation in technology and contribution



1. *ACMA Press Release, July 2025*

to the overall growth of the automotive sector in India. Analyzing their financial and growth metrics over the last five years allowed us to gain valuable insights into the trends and challenges faced by these companies, providing a well-rounded perspective on the automotive component industry in India. Our analysis also validates these patterns:

- **Capability and powertrain-diversified companies** demonstrate stronger revenue growth (higher CAGR), albeit with slightly more volatility.
- **Geographic and customer or channel diversification** deliver more stable revenue streams (lower coefficient of variation), even if growth is moderate.
- **Diversified firms outperform in profitability,** with higher average margins and significantly more stable return on capital employed (ROCE), especially during downturns like COVID-19.
- **Large specialist firms lag diversified peers,** highlighting that scale without spread increases risk exposure.

Importantly, **diversification works best when its capability led.** Companies that have expanded their technical base are more likely to succeed in other diversification paths. Conversely, those diversifying by industry alone often do so in a siloed manner, without enabling broader transformation.

For successful execution, diversification should be:

- **Strategic, not opportunistic:** Aligned with core strengths and a long-term vision.
- **Phased and piloted:** Tested judiciously before scaling.
- **Supported by systems and governance:** With strong internal governance, cross-functional interactions and a robust digital infrastructure.

In conclusion, diversification is no longer a choice; it is a structural pivot.

The payoff is compelling—improved resilience, higher valuations and a stronger opportunity to operate in a complex, fast-moving world.

The Indian auto component industry is at a critical juncture, where it has the opportunity to leap ahead by embracing deliberate, capability-driven diversification strategies. Those who lead this shift will define the future of the sector—not just as suppliers, but as solution collaborators in the mobility ecosystem.



Chapter 01

Importance of business diversification for the industry



"In a world where disruption is the norm, staying the same is the biggest risk."

The global automotive industry has always been in motion. However, the pace and nature of change over the past two decades have been unlike anything seen before. From being a product-led sector focused on hardware, it has evolved into a complex network of technologies, software-defined vehicles, services, and ecosystems. Global suppliers, once known for a specific set of products, now deliver integrated modules spanning electronics, control systems, and even digital platforms. The supply chain has globalized, and value has steadily shifted from metal and mechanics to intelligence and energy.

The global automotive component market was valued at over approximately US$2 trillion in 2025, with about ~US$700[2] billion traded across borders. Despite its strong manufacturing base, India's share in this global trade remains a modest 3% (approximately US$20 billion)[2] –a reflection of both how far the country has come and how much potential lies ahead.

India's automotive component sector has grown within the context of this global shift. Liberalization in the early 1990s marked a turning point. The entry of international OEMs into the Indian market brought with it new demands for quality, cost, and delivery. Indian suppliers responded by investing in capabilities, scaling operations, and embracing global standards. Several of them transitioned from being single-product vendors to multi-product, multi-customer businesses. This transition was not just about growth; it was about competing with global players.

2. *"Automotive Industry: Powering India's Participation in Global Value Chains", Niti Aayog, April 2025*

Over the last decade, this evolution has been fueled by robust domestic vehicle sales, a growing aftermarket, and expanding exports. Between FY20 and FY25, the industry nearly doubled in size—reaching a turnover of over INR6.7 lakh crore (approximately US$80 billion)[3]. Exports have also gained momentum, rising to US$22.9 billion[3] in FY25 and pushing the sector into a trade surplus of US$453 million[3]—a powerful indicator of its strengthening global relevance.

Figure 1: Market size of Indian auto component industry 2015-2025 (US$ bn)[4]

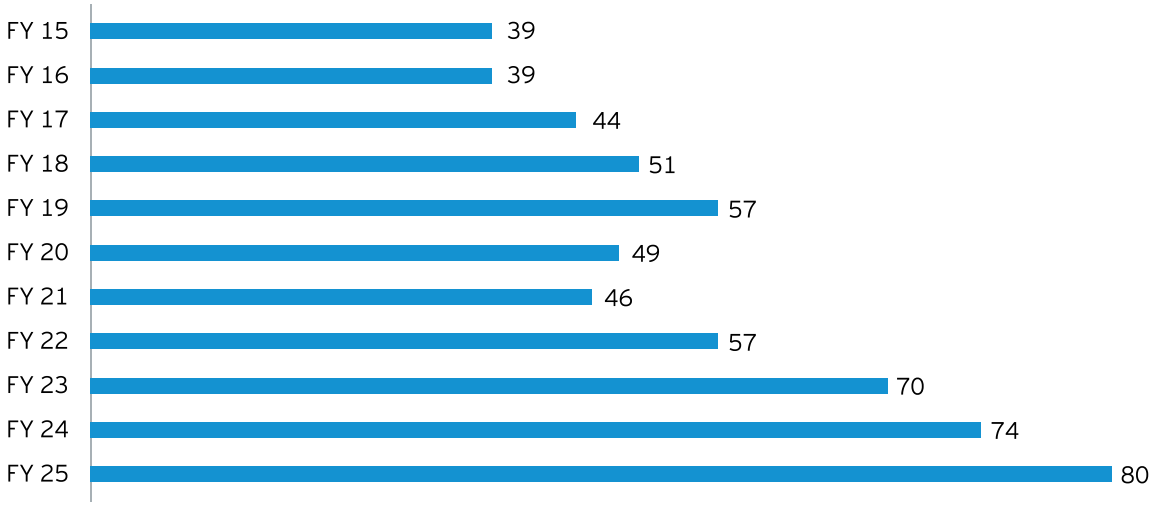


Figure 2: Evolution of Indian automotive industry

Key milestones

Early phase (pre 1991)
- 1950s-60s: Local manufacturing gathers pace; import-dependency present
- 1970s-80s: Protectionist policies; limited competition

National economic policy 1991
- 1991: Economic reforms open markets to FDI and global players
- 1993: Auto Policy encourages collaborations
- 1997: Tier wise supplier ecosystem emerges

Rapid growth (2000-2010)
- 2002: Automotive Mission Plan boosts investments
- 2006: India becomes a hub for low-cost, high-quality components
- 2008-09: Global financial crisis slows exports briefly

Maturity and challenges (2010-2020)
- 2015: "Make in India" pushes local manufacturing accompanied by other gov policies
- 2018: BS-VI norms and tech driven upgrades
- 2020: COVID-19 disrupts supply chains; 30% production drop

Recovery and EV Shift (2020-Present)
- 2021: PLI (Production-Linked Incentive) scheme
- 2023: Surge in new energy vehicles component demand
- 2025: Sector turnover reached INR 6.73 lakh crore (~US$80.2 b) in FY 25, doubling since FY 20 at 14% CAGR

3. *ACMA Press Release, July 2025*
4. *ACMA, Industry Statistics, 2025*

Diversification has played a quiet but critical role in this journey. Companies that once relied on a single customer or product line began expanding their offerings—first into adjacent categories and later into entirely new verticals. This approach helped reduce concentration risk, improve asset utilization and built resilience. It also became a pathway into global markets, as diversified players could offer more integrated solutions to OEMs looking to consolidate their supply chain.

Over time, the concept of diversification has shifted from being optional to strategic. Today, this shift is being accelerated by technology. The auto industry is undergoing a fundamental reset. The move from internal combustion to new energy powertrains, the rise of connected and autonomous vehicles, and the growing focus on lightweighting and emissions are all reshaping the component landscape. Many legacy product lines face long-term obsolescence, while others are being commoditized or replaced by software-driven alternatives.

For auto component manufacturers, this creates both a challenge and an opportunity. Those with narrow product portfolios risk being left behind. Conversely, those with the foresight to diversify—into electrification, electronics, clean technologies, or adjacent industries—are better placed to navigate the future. The global move towards electric vehicles alone may generate a US$300 billion[5] domestic market for EV batteries in India by 2030—representing a massive new value pool for suppliers willing to pivot.

EV adoption in India is also accelerating at pace—E2W penetration has risen from just 0.1% in FY20 to 6.2% in FY25[6], while E3W adoption has surged from 7.5% in FY23 to 22.6% in FY25[6] . Enabling policy frameworks such as FAME II, PLI schemes, and state-level subsidies reinforce this momentum.

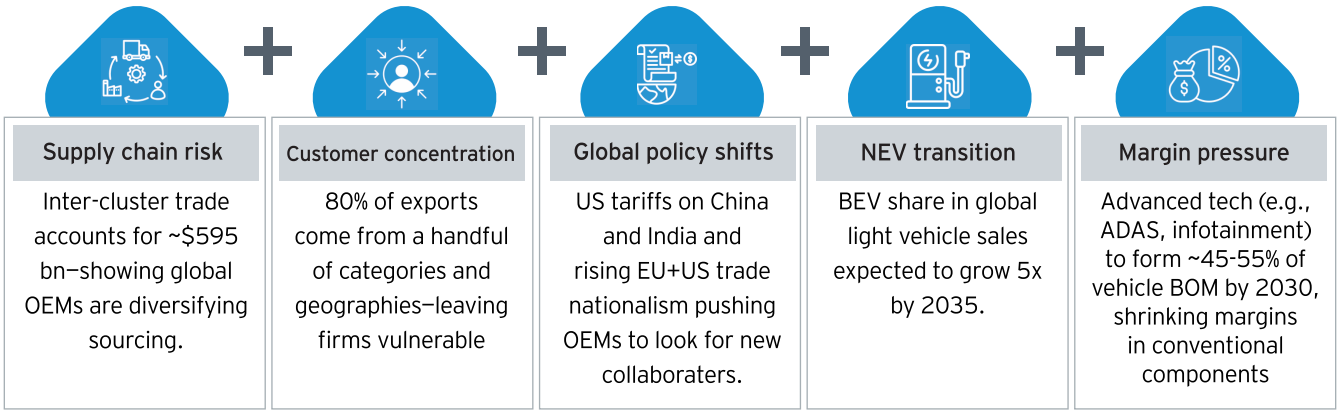
Looking ahead, the Indian government aims for 30% of private car sales, 70% of commercial vehicle sales, and up to 80%[7] in two- and three-wheelers to be electric by 2030—pointing to a structural and irreversible shift away from ICE.

Several forces are pushing companies to rethink their product portfolios and explore new growth paths.



5. *"Auto Components", IBEF (India Brand Equity Foundation) report, May 2025*
6. *VAHAN Portal Data, Ministry of Road Transport & Highways, multiple years*
7. *Confederation of Indian Industry (CII) data, February 2025*

Figure 3: What is driving diversification?



In response, many organizations are already investing beyond core mechanical systems and stepping into new domains such as embedded software, battery systems, thermal management and SaaS to name a few.

This shift is not just technological; it reflects a broader industry truth: resilience comes from diversification. Companies with exposure to multiple markets, technologies, and customer segments are more likely to withstand cycles, adapt to change, and unlock new growth. In today's context, diversification is not just about expanding business—it is about reducing risk, staying relevant and building for the long term.

As the rest of this report will show, diversification strategies in the auto component industry are taking many forms. But at the core of each is a simple idea: the need to future-proof the business in an uncertain and fast-changing world.



Chapter 02

Understanding the dimensions of diversification



Diversification, amongst other things, is a deliberate strategy for businesses to reduce risk and build resilience. For auto component manufacturers, it means not being overly dependent on a single capability, product, customer or market. While the word "diversification" is often used broadly, it has multiple dimensions, each addressing a different source of vulnerability or risk. A company may be highly diversified in one area while being a specialist in another.

We considered five core types of diversification: capability, powertrain, geographical, industry and customer or channel. These types are not mutually exclusive and companies often progress through more than one dimension. However, they should be viewed separately, as each dimension reduces a specific kind of business risk.

Figure 4: Diversified vs. Specialist firms



Specialist Company

- Capability-led diversification
- Powertrain-led diversification
- Geography-led diversification
- Industry-led diversification
- Customers or channels-led diversification

Diversified Company



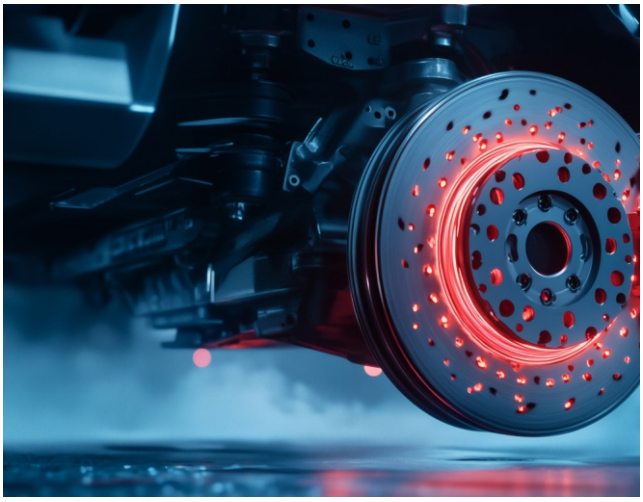
Capability-led diversification refers to the variety of technical competencies or production technologies a company possesses. If all of a company's products rely on the same underlying process, material or structure, it is considered a specialist in terms of capability.

> *For example, a manufacturer focused on aluminum die casting for engine housings, chassis brackets, and transmission covers may have a wide product catalog, but all of it is tied to one core manufacturing skill. This firm faces high exposure if casting-based components witness a structural decline. In contrast, another firm that started with HVAC systems and expanded into plastic molding, electronic control units and sensor integration building capabilities in multiple domains. Even if one capability becomes obsolete, others may continue to remain relevant. Capability diversification reduces the risk of obsolescence linked to technological shifts. It can also be motivated by a need for increased customer wallet share, leading to stronger business ties and better negotiating power.*

Powertrain-led diversification involves serving a mix of powertrains, including ICE, alternative fuels like CNG and LNG and the growing segment of new energy vehicles. The addition of powertrain-agnostic components, such as structural or electronic components, also helps insulate a company from changing trends in the industry.

> *A company with rubber and plastic molded parts in its portfolio would get impacted when powertrains shift to accept ethanol-blended fuel. In contrast, a diversified company with products and material compositions developed specifically for higher ethanol concentrations is better suited for this change in the automotive industry.*

By modifying product designs and processes, the company can adapt to different vehicle architectures. This approach spreads volume risk and allows the business to tap into newer, faster-growing segments. Powertrain diversification enables a company to avoid being tied to the fate of a single vehicle category.



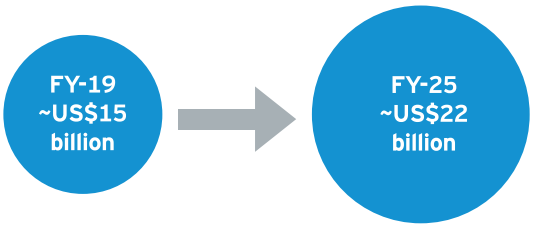
Geography-led diversification helps reduce dependence on any one country or region. Auto component companies often start by serving domestic OEMs, but as supply chains globalize, many have entered international markets.

> *For instance, a suspension systems supplier that operates solely in India may be vulnerable to domestic demand cycles, policy shifts, or currency fluctuations. In contrast, a wiring harness manufacturer that gradually expanded into Southeast Asia and the Middle East began by supplying to Indian OEMs with export programs and later built distribution channels in new markets. By doing so, it reduced exposure to any one geography and built a more stable revenue base. The company incorporated this learning into its strategy by maintaining revenue dependence on a specific market never exceeds approximately 30%, thus limiting exposure to geographic risk.*

Geographical diversification acts as a hedge against localized disruptions. Indian auto component exports touched US$22.4 billion in FY25[8],reflecting how the industry is actively diversifying geographically. Major export destinations for India include the US, Germany, Turkey, and Brazil, which together account for approximately 40% of exports.

8. *ACMA, Industry Statistics, multiple years*

Figure 5: Growth in the value of auto component exports from FY-19 to FY-25[8]



Industry-led diversification involves applying core competencies to sectors beyond automotive. For many component manufacturers, this can be a natural next step.

A firm that produces driveline assemblies for passenger vehicles may find similar demand in the tractor segment, defense vehicles or railway segment.

This move requires some degree of re-engineering, certification and customer development, but the underlying expertise remains relevant.

> *One example is a company known for high-strength fasteners that initially served only automotive customers but later expanded to serve railway and construction equipment manufacturers. The business was able to navigate multiple sector cycles and improve the utilization of its production assets.*

Industry diversification reduces sector concentration risk and creates new growth opportunities during slower periods in the automotive market.

Customer and channel-led diversification is about expanding who you sell to and how you sell. Many component manufacturers rely on a few OEMs or tier-1 customers for the bulk of their business, which creates exposure to pricing pressure, contract renegotiations, and order volatility.

> *One firm supplying dashboards and interior panels faced this challenge until it began developing direct-to-customer (D2C) aftermarket kits. It also onboarded fleet operators and logistics players with ready-fit cabin upgrade solutions. These new channels provided better margin control and a more balanced order book. By serving different types of customers and exploring new go-to-market models, the company reduced its dependency on a single channel and improved long-term stability.*

Table 1: Dimensions of diversification

Diversification type	Specialist company	Diversified company
Capability	Castings across multiple parts	HVAC + thermal electronics + plastic moulding
Powertrain	Exhaust system supplier	Exhaust and battery thermal management system supplier
Geography	Domestic-only suspension supplier	Wiring harness player in India, SE Asia, Middle East
Industry	Fasteners for passenger vehicles	Fasteners for auto, rail, construction equipment
Customer/ Channel	Supplies only to two OEMs	Mix of OEM, fleet, and D2C aftermarket

Each type of diversification mitigates a specific business risk. Capability diversification reduces the risk of being tied to one production method. Powertrain diversification guards against shifts in a single vehicle category. Geographical diversification protects itself from region-specific slowdowns. Industry diversification spreads exposure across demand cycles. Customer or channel diversification limits overdependence on a few buyers or business models.

However, diversification comes with its own complexities. It adds cost, requires cross-functional talent and demands thoughtful execution. Not every company can diversify in every way. The right path depends on market conditions, competitive strengths, and internal bandwidth. Some may choose to deepen their capabilities first before expanding into new geographies, while others may find adjacent industries more accessible than new powertrains.

What matters is that organizations should view diversification not as a buzzword but as a set of deliberate choices. These choices should align with long-term goals and be rooted in a clear understanding of where risks lie.

8. *ACMA, Industry Statistics, multiple years*



Chapter 03

Navigating uncertainty: Why diversification has become a strategic imperative



For decision-makers in India's auto component industry, the world today is far more volatile than it was even five years ago. The pace of disruption has increased and the sources of risk have multiplied. What were once stable growth paths are now exposed to overlapping shocks—from technology shifts and policy changes to geopolitical tensions and demand-side fragmentation.

The COVID-19 pandemic alone pushed back the industry's growth trajectory by nearly three years. Between FY19 and FY21, total industry turnover fell from INR3.95 lakh crore (approximately US$57 billion) to INR3.4 lakh crore (approximately US$45.9 billion), with exports dropping nearly 8% in FY21.[9]

More recently, China's restrictions on the export of rare-earth magnets—a critical input for EV motors and other components—triggered immediate concerns across the Indian automotive value chain. Several OEMs and suppliers were forced to explore alternative sourcing or build strategic inventories, highlighting the fragility of concentrated supply chains.

In this new environment, diversification is no longer optional; it is a strategic necessity for companies that want to stay relevant, reduce concentration risk, and build resilience. Leadership teams should proactively identify where they are exposed—by customer, market, capability or geography—and act to mitigate that risk before it materializes into disruption.

There are five powerful triggers that make this the right time for top managements to evaluate or rethink their diversification strategy.

9. *ACMA Industry Statistics, 2022*

Technology disruption in the auto sector

The most visible change is the transition from internal combustion engines to new energy powertrains. This is not a gradual evolution; it is a structural shift that is redefining what goes into a vehicle. Components linked to the engine, gearbox and exhaust systems are facing fundamental changes. Meanwhile, new categories like battery systems, thermal management, lightweight materials, and embedded electronics are growing rapidly.

For a component manufacturer deeply tied to ICE platforms, this shift poses a significant risk. Entire product lines could become obsolete over the next decade. The opportunity in EVs is not just about switching products; it often requires new design skills, material expertise, and testing protocols. Companies that have invested in multiple technical capabilities—for example, mechanical systems, plastic molding, and power electronics—are better placed to navigate this transition.

At the same time, the vehicle itself is becoming a connected platform. Embedded software, diagnostics, and sensor integration are moving from the sidelines to the center. Component firms that do not diversify beyond traditional hardware may find themselves locked out of future supply chains.

Economic and policy shifts

Macroeconomic uncertainty has become a feature, not a phase. Inflation, interest rate volatility and commodity price swings are making input costs difficult to predict. OEMs, in turn, are passing down pricing pressure to their suppliers. This is especially challenging in a market where India already faces an approximate 10% cost disadvantage[10] (driven by raw material and logistics) compared to countries like China.

Policy changes are adding another layer of complexity. In India, schemes like the Production Linked Incentive (PLI) and Phased Manufacturing Plan (PMP) are reshaping the economics of component manufacturing. The PLI scheme alone is expected to generate INR2.31 lakh crore (approximately US$31 billion) in incremental output and attract INR42,500 crore in new investments—while also creating 7.5 lakh jobs over the next five years.[11]

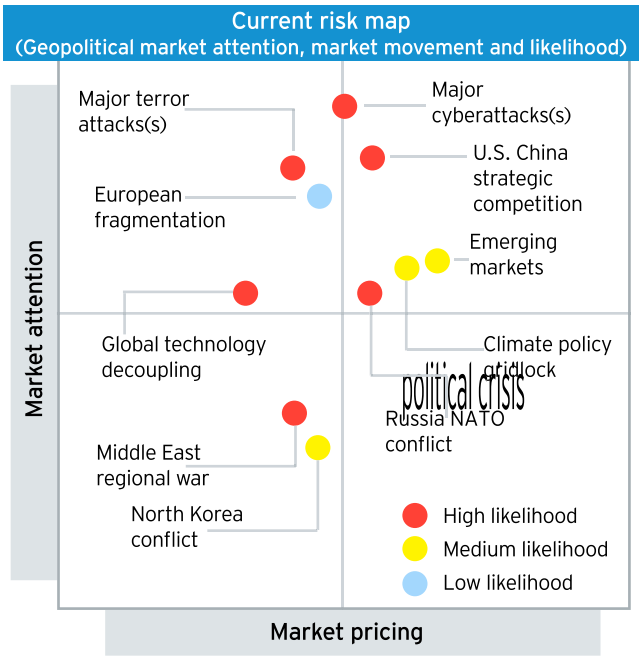
Local content rules and import substitution policies are becoming stricter. Export destinations are also introducing green norms, carbon disclosures and localization requirements. These shifts are redefining which product lines and operating models will remain viable in the long term.

Diversification helps companies navigate this uncertainty. Firms operating in multiple product categories, markets and customer channels are more capable of absorbing regulatory or cost-side shocks. Specialized companies, however efficient, may find themselves vulnerable if policy direction changes suddenly.

Geopolitical risk and supply chain fragility

The last few years have seen a sharp rise in external disruptions. COVID-19 may have been the trigger, but the risks have only grown since. The Russia-Ukraine war impacted freight corridors and disrupted input flows. Passenger vehicle production in Russia fell by 67% in 2022[12], and key rail corridors supplying components to European OEMs were severely affected. This ripple disrupted their sourcing patterns.

Figure 6: Geopolitical risk climate



10. *"Automotive Industry: Powering India's Participation in Global Value Chains", Niti Aayog, April 2025*
11. *"Centre's auto incentive scheme to create incremental output of INR 2.31 lakh crore" The Economic Times, February 2022*
12. *"Russia's car production slumped to lowest since Soviet times in 2022" The Reuters, February 2023*

Rising tensions between Israel and Iran have made the Middle East—a critical energy and logistics hub—more unpredictable. China's export restrictions on rare earth metals have exposed how concentrated global supply chains really are.

The US-China trade war continues to reshape sourcing and market access. A 25% tariff on imported auto components imposed by the US in 2025 has added pressure on India's US$6.8 billion[13] export market, especially for suppliers focused on powertrain and braking systems.

Many global OEMs are reconfiguring supply chains through a "China+1" approach, creating both opportunities and threats for Indian suppliers. At the same time, regional trade blocs and preferential sourcing rules are becoming more common, forcing firms to localize production or risk losing access.

In this environment, Free Trade Agreements (FTAs) are emerging as critical enablers of geographic diversification. India has recently signed a landmark FTA with the UK, and has trade agreements with the UAE, South Korea, Australia, etc., marking a shift toward deeper integration with key export markets. Under the UK-India FTA—signed in July 2025—car import duties will be phased down from over 100% to around 10% under a quota regime, and nearly 99% of Indian export lines will move toward zero tariffs[14]. For Indian component manufacturers, this opens a tariff-efficient route to serve UK-based OEMs.

Geopolitical risks are rarely within a company's control, but their impact can be managed through diversification. Firms that operate in multiple regions, with varied customer bases and inputs, are better insulated. Those with narrow exposure—to one country, supplier, or route—are far more vulnerable to external shocks.

Customer consolidation and channel evolution

OEMs across the world are streamlining their vendor base. They want fewer associates who can deliver more—not just in terms of volume, but also value. System integration, software compatibility, and after-sales support are increasingly being bundled into contracts.

This shift places pressure on component suppliers who have built their businesses around a single part or function. Without diversification into adjacent offerings, customer solutions, or aftermarket services, they risk becoming replaceable. In some segments, digitalization is also disrupting the traditional value chain. Online retail, direct-to-customer models, and platform-led spare parts distribution are redefining how buyers engage.

Fleet operators are another case in point. They now expect complete uptime packages—not just for parts, but also diagnostics, maintenance schedules and digital integration. Suppliers that have diversified into services or platform-based offerings are gaining strategic importance in these relationships.

For leadership, this means one thing: staying narrowly focused on B2B supply to OEMs is increasingly risky. Diversification into channels, customers, and delivery models is essential to remain competitive.

Market volatility and concentration risk

Many component manufacturers continue to depend heavily on a few customers, products or platforms. This has worked well in stable markets, but the current environment is anything but stable. A slowdown in one region, a production halt at one OEM, or a policy shift in one product segment can wipe out significant revenue if the business is too concentrated.

Even companies with healthy balance sheets are exposed if they lack diversification. What diversification offers is not just growth potential—it offers insurance. By entering adjacent industries, exploring new geographies or adding new capabilities, companies can reduce the chance of all variables turning unfavorable at the same time. Risk is not always visible until it materializes. Diversification is how businesses get ahead of it.

Table 2: Decision lens: A leadership call-out exercise, a simple list of 5 Yes/No questions

✓	✗	Are more than 50% of your products dependent on ICE platforms?
✓	✗	Is your export revenue tied to fewer than 3 countries?
✓	✗	Would the loss of your top customer impact more than 30% of revenue?
✓	✗	Have you entered any new capability areas in the last 3 years?
✓	✗	Do you have a business continuity plan in case of global logistics delays?

13. *"Trump's 25% auto tariffs cast uncertainty over India's $7 bn component exports" The Economic Times (Auto)| CRISIL, March 2025*
14. *"India-UK CETA 99% Tariff Elimination, Stronger Bilateral Trade, Catalyst for Inclusive Growth" Ministry of Commerce and Industry, July 2025*

These are not theoretical risks; they are happening in real time. The world is rewarding companies that are agile, diversified and future-ready. For boards and CXOs of Indian auto component manufacturers, this is the moment to act. Diversification cannot be a reactive decision triggered by loss; it should be a proactive strategy built on foresight.

Each company will have its own path. But the direction must be clear. The environment is shifting—and the winners will be those who are prepared for more than one future.

The implications of diversification: What leadership should expect

Diversification brings with it a range of outcomes—most of them highly positive, especially when approached with the right intent and alignment. At the same time, it requires organizational readiness to manage new complexity. Below is a balanced view of what organizational leadership can expect.

Strategic and financial benefits

Increased revenue potential

New products, markets and customer segments expand the company's addressable opportunity. Diversification also enables access to different price points and demand cycles, improving volume and topline growth.

Improved risk management

Exposure is spread across regions, customers and industries. This reduces vulnerability to local disruptions, regulatory changes, or demand shocks in a single segment.

Stronger strategic relevance with customers

Diversified companies are more likely to be seen as long-term associates. They can offer bundled solutions and platform-wide integration, increasing their influence in OEM account planning.

Cross-selling opportunities

Serving multiple customer bases allows insights to be shared across domains. Products or services developed for one segment can often be adapted for another with minimal investment.

Better utilisation of core assets

Engineering, manufacturing or sourcing capabilities developed for one line of business can often be repurposed for others, leading to better return on assets.

Greater negotiating power with suppliers

Consolidated sourcing across diverse business lines increases leverage with suppliers. This often leads to better pricing, terms, or access to scarce materials.

Acceleration of organisational learning

Exposure to different markets and customer needs pushes teams to innovate faster. This encourages agility and builds broader problem-solving capability across the organization.

Trade-offs to manage

Operational complexity

Diversification increases the number of products, platforms or geographies under management. This requires stronger coordination, governance and systems.

Upfront investment

Entering new capabilities or markets typically involves capital expenditure (capex), new talent onboarding and development time. The payback may not be immediate.

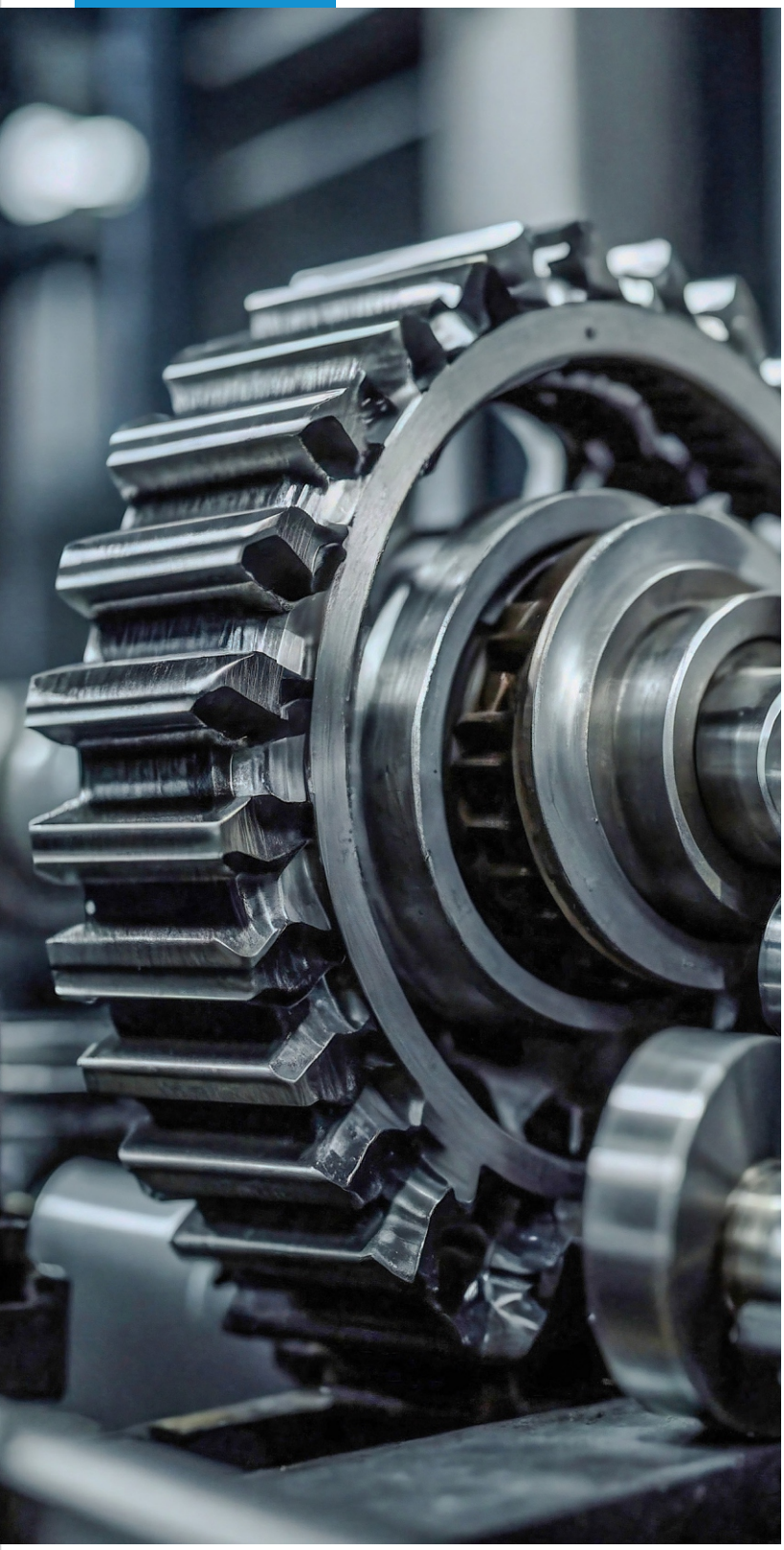
Longer gestation periods

Some diversification initiatives may take time to break even, especially in new industries or technologies. Managing expectations is key.

These challenges are not roadblocks; they are the cost of enhancing a business that is more resilient, more agile and better positioned for long-term success. For leadership teams, the role is to anticipate these implications, prepare the organization for them and stay focused on the long-term value creation that diversification can provide.

Chapter 04

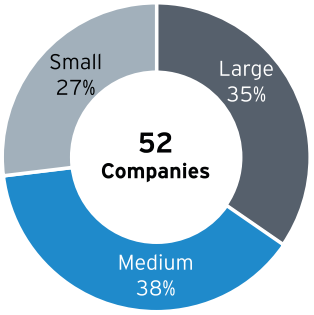
Evidence in action: Measuring the impact of diversification



Approach

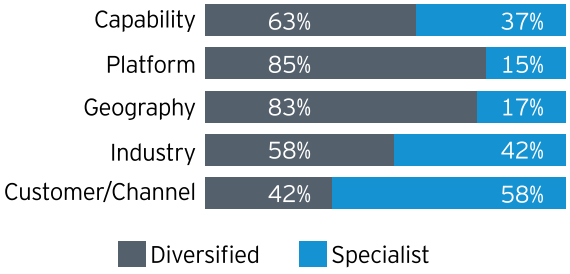
Moving beyond strategic theory to examine how diversification plays out in practice across the Indian auto component industry, the following analysis draws on a dataset of 52 companies spanning small, medium, and large enterprises[15], selected to provide a balanced cross-section of the sector (figure 7) .

Figure 7: Sample data set by company size



Each company is classified across five dimensions of diversification—capability, powertrain, geography, industry, and customer or channel—based on disclosed operations, product offerings, and market presence (figure 8). The sample includes an even split between firms that are "diversified" and those that are more "specialist" in orientation[16] (figure 9).

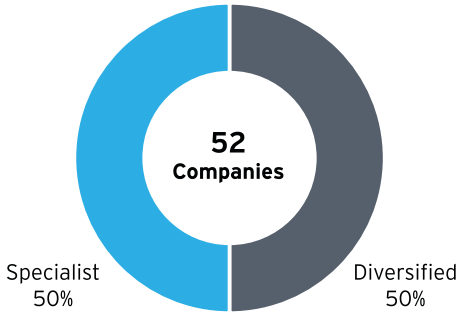
Figure 8: Sample data set by dimensions of diversification



15. *Size categorization based on the following conditions: Small - <INR1,000 crore annual revenue, medium - INR1,000 - 3,000 crore annual revenue and large - >INR3,000 crore annual revenue.*

16. *Companies are classified as overall 'diversified' if they are diversified across 4 or more dimensions of diversification.*

Figure 9: Sample data set by diversification classification



To assess the relationship between diversification and business performance, the study considers financial and operational metrics from FY-18 to FY-24—including revenue, net profit margin, return on capital employed (ROCE), market capitalization (for public companies), and debt-to-equity ratio.

A statistical measure—the Coefficient of Variation (CV)—is used to assess the relative volatility in performance over time. This allows for a more complete understanding not just of how much companies grow, but how consistently they perform (figure 10).

Figure 10: Coefficient of Variation explanation

What is the Coefficient of Variation?

*The **Coefficient of Variation (CV)** is a statistical measure used to assess the **relative volatility** of a metric over time. It is calculated as the ratio of the standard deviation to the mean, expressed as a percentage.*

CV = Standard Deviation ÷ Mean

What it tells us:

*CV indicates how much a company's performance fluctuates relative to its average. A **lower CV** suggests more stable, consistent results. A **higher CV** implies greater variability and risk.*

Insights – Topline

At a headline level, there is little difference in overall sales growth between diversified and specialist companies over the past six years. However, a more granular look across different types of diversification reveals important nuances.

Companies that are diversified in terms of **capability** and **powertrain** have on average delivered stronger sales growth than their specialist peers within these categories (figure 11). This reflects the advantages of expanding into adjacent product areas or aligning with shifts in vehicle architecture, such as the rise of electric mobility. These strategies appear to open new growth avenues. At the same time, they are associated with marginally higher variation in year-on-year sales. Although part of this variation can be explained by high growth, the high CV of sales metric suggests that such expansion can introduce a degree of operational and market complexity—though not necessarily at the cost of overall performance (figure 12).

Figure 11: Sales CAGR FY18-24 of capability and powertrain diversified companies

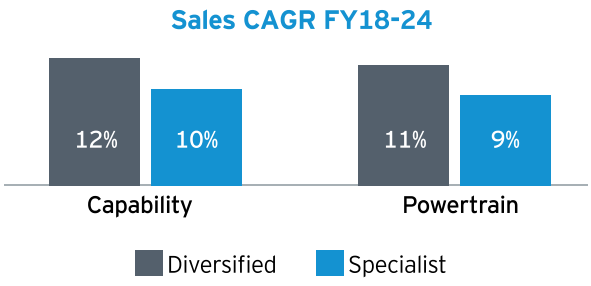
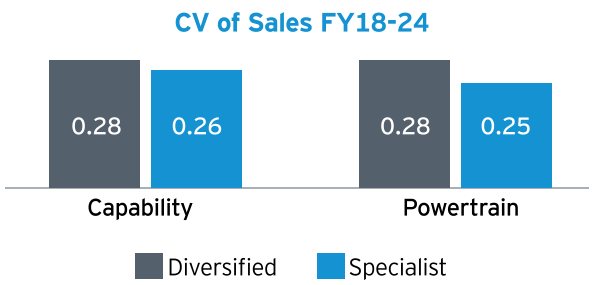


Figure 12: CV of sales FY18-24 of capability and powertrain diversified companies



Key Insight:
Companies diversified in capability and powertrain dimensions experience markedly higher topline growth, although with marginally higher volatility or risk. These types of diversifications allow companies to access new growth avenues but introduce layers of operational complexity, thereby increasing volatility.

In contrast, firms that are diversified by **geography, industry** or **customer or channel** tend to post slightly lower sales growth than their specialist counterparts—though with greater consistency (figure 13 and 14). The dip in sales growth is partly attributed to the complexities involved in adding new markets, channels and customer groups to the business mix. These changes require time to navigate and post results. However, the Coefficient of Variation is lower in these categories, indicating more stable topline outcomes over time. These forms of diversification offer a natural hedge against volatility, helping firms smoothen demand shocks and maintain predictable revenue flows, particularly in an environment marked by supply chain fluctuations and uneven end-market recovery.

Figure 13: Sales CAGR FY18-24 of geography, industry and customer or channel diversified companies

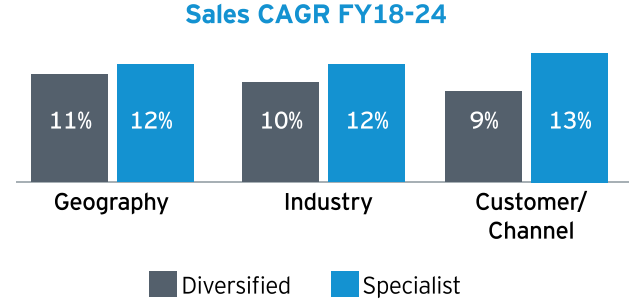
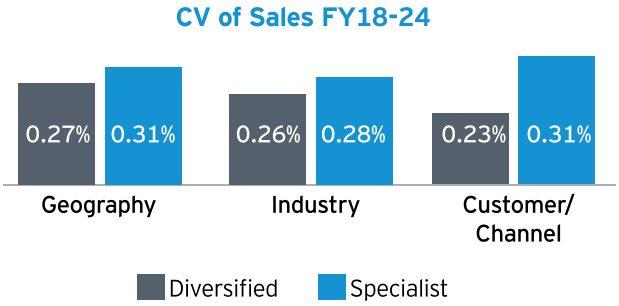


Figure 14: CV of sales FY18-24 of geography, industry and customer or channel diversified companies



Key Insight:
Companies diversified in geography, industry and customer or channel dimensions experience more stable revenue growth (lower CV), although at a slower pace. They provide a natural hedge against market cyclicity and demand shocks.

Taken together, the data suggests that different types of diversification serve different strategic purposes. **Capability** and **powertrain** diversification support **expansion and future readiness,** allowing companies to participate in a broader set of opportunities. **Geography, industry** and **customer or channel** diversification, meanwhile, play a more **protective role,** strengthening a firm's ability to navigate short-term uncertainties without necessarily altering its growth trajectory. Both sets of approaches carry value—the key lies in how they align with the company's broader priorities and stage of evolution.

Insights - Profitability

From a profitability lens, diversified companies appear to have an edge. On average, these firms report slightly higher net profit margins (6%) than their specialist counterparts (5.5%), suggesting that a more balanced business mix may help in achieving better operational efficiency and cost control across cycles (figure 15).

This advantage extends to stability to an even greater extent. Diversified firms not only deliver stronger margins but also report significantly lower volatility in profitability (approximately 23% lower), as measured by the CV (figure 16).

Figure 15: Average net profit margin FY18-24

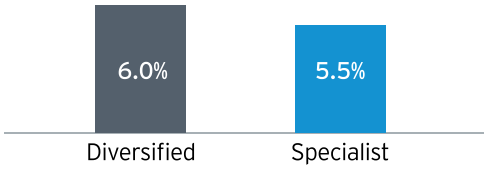
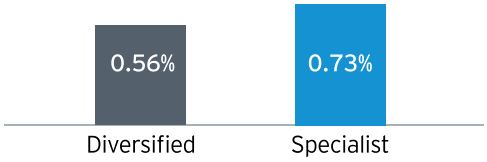


Figure 16: CV of net profit margin FY18-24

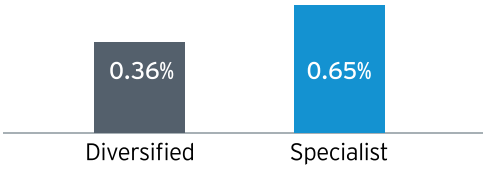


Key Insight:
Diversified companies experience marginally higher average net profit while also posting more consistent returns, as diversification helps them access new, profitable markets, improve operational efficiency and hedge against demand. volatility.

The difference is particularly striking in the case of Return on Capital Employed (ROCE)—a key global indicator of business health and efficiency. While the average ROCE is broadly similar across diversified and specialist firms, the CV of ROCE is significantly lower among diversified companies, suggesting greater consistency in generating returns across business cycles (figure 17).

CV of ROCE is increasingly used by financial analysts, investment managers, and credit rating agencies as a proxy for business risk, especially when market-based risk metrics like beta are unavailable or unreliable. Credit rating agencies often monitor the stability of ROCE over multi-year periods to assess a company's financial resilience. By capturing the volatility of return generation over time, it offers a grounded view of how resilient a company's core operations truly are—and in this case, highlights the stabilizing effect of diversification.

Figure 17: CV of ROCE FY18-24



Key Insight:
Coefficient of Variation (CV) of Return on Capital Employed (ROCE) – a key metric to measure business risk – is significantly lower for diversified companies, suggesting a much lower risk profile. This adds significant value when read in conjunction with a higher net profit and lower risk profile of the organizational topline.

The practical value of this resilience becomes clearer when examining the COVID-19 period. During the ensuing economic disruption of FY21, specialist companies experienced a much steeper decline in both profit margin and ROCE (figures 18 and 19). The sharper impact may reflect their narrower operating scope, which left them more exposed to downturns in specific customer segments or product categories.



Figure 18: Net Profit Margin Over Time FY18-24

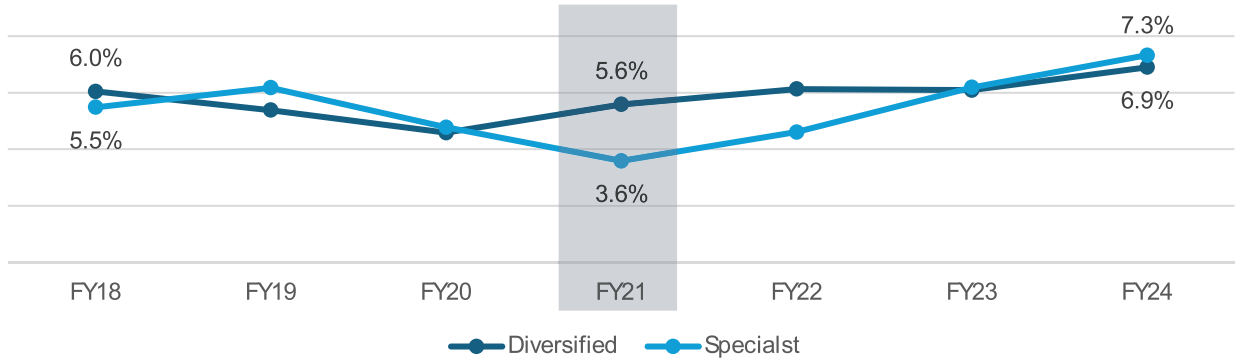
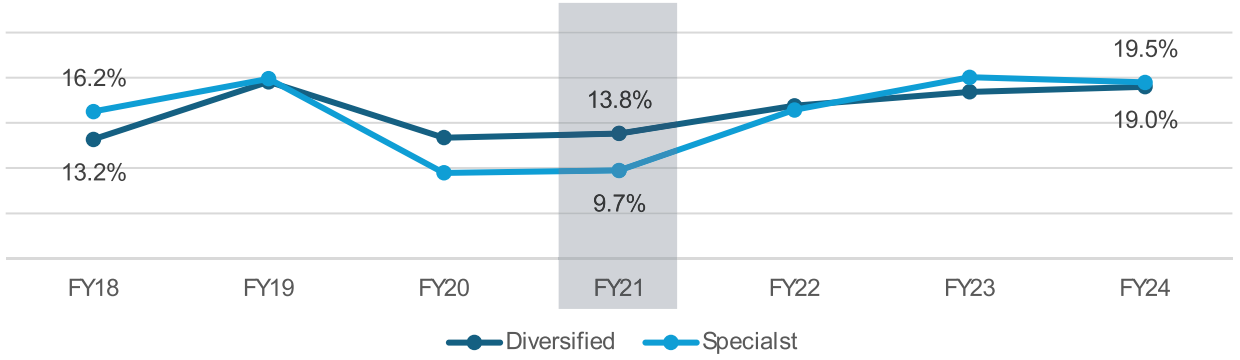


Figure 19: ROCE over time FY18-24



Key Insight:
The lower risk profile of diversified firms can clearly be seen during the impact of the COVID-19 pandemic. The differential of both average net profit margin and average ROCE between diversified and specialist firms is at its peak during FY21, as diversified firms are better equipped to handle such market-wide disruptions.

An additional insight emerges when focusing on large-sized specialist firms. Among bigger players, the lack of diversification appears to have a more pronounced effect—these companies show materially weaker performance on profitability metrics compared to large, diversified firms (figures 20 and 21). As larger firms scale, they face more intense competitive pressures and greater capital deployment requirements, making the absence of diversification more costly. This trend is also reflected in their market capitalization, where specialist large companies significantly lag their diversified peers.

Figure 20: Average ROCE of large companies FY18-24

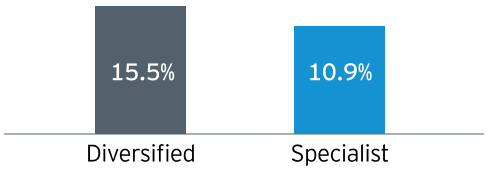
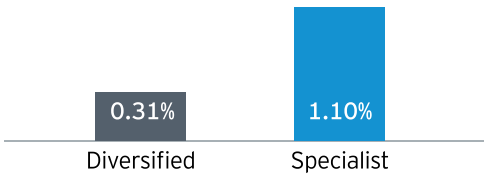


Figure 21: CV of ROCE of large companies FY18-24



Key insight:
Large specialist firms are lagging large-diversified firms in nearly all financial metrics. The average ROCE of large-diversified firms is significantly higher, with a much lower risk profile, highlighting the importance of diversification when pursuing scale.

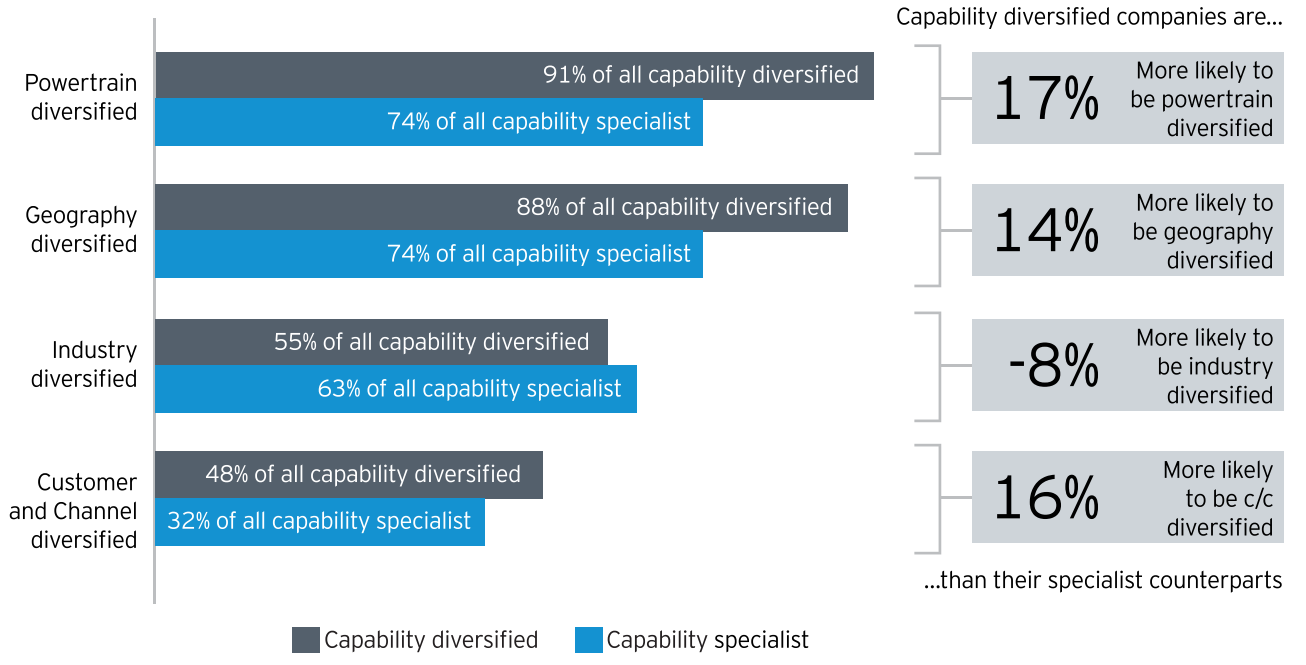
These patterns suggest that diversification is not only about unlocking topline growth—it also plays a crucial role in increasing and stabilizing profitability, especially during periods of economic stress. For larger firms in particular, strategic diversification appears increasingly important in maintaining investor confidence and long-term financial strength.

Synergies between diversification categories

Diversification rarely exists in isolation. Certain types of diversification appear to reinforce others—forming a network of strategic synergies that enable firms to scale more effectively.

For instance, organizations that diversify by capability—by adding new processes, technologies or product competencies—are significantly more likely to be diversified across other dimensions as well (figure 22). Capability diversification equips firms with the foundational tools needed to enter new powertrains (e.g., EVs), serve new geographies, engage with different industries or build relationships across varied customer segments. In that sense, it acts as a launchpad for broader diversification, reducing the cost and friction of expanding into new domains.

Figure 22: Other types of diversification of capability diversified/specialist companies

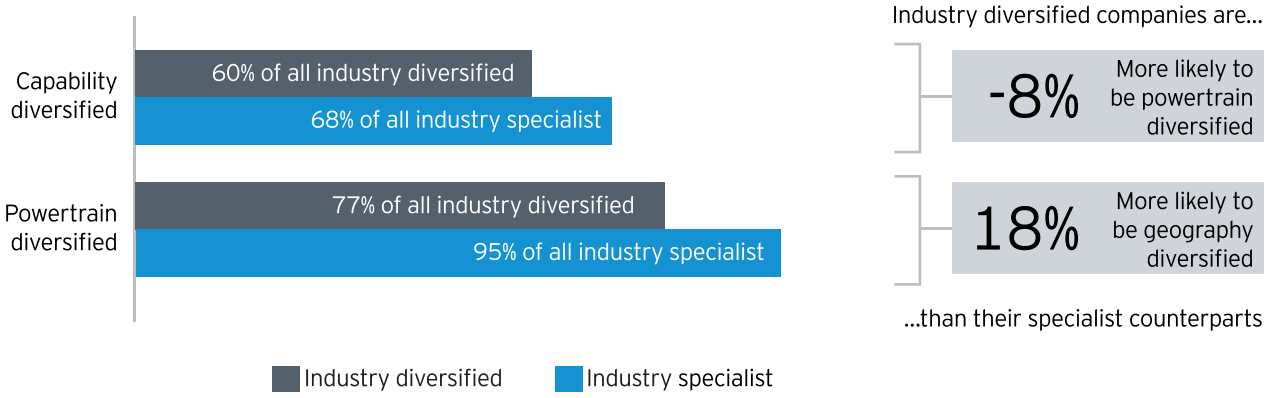


How to read the graph:
Taking the first example, 91% of all companies that are capability diversified are also powertrain diversified, whereas only 74% of capability specialist companies are powertrain diversified. A similar trend is seen in geography and customer or channel diversification.

In contrast, companies that are industry-diversified—meaning they serve end markets beyond automotive—tend to be less diversified in other categories (figure 23). This may reflect strategic focus: firms stepping outside the core industry often do so through specialized verticals or carved-out product lines, which do not necessarily require broader powertrain, customer, or geographic diversity. In such cases, diversification is more about insulating from automotive cyclicality than expanding reach within it.

Key Insight:
Capability diversified firms are more likely to be powertrain, geography and customer or channel diverse. This suggests that capability diversification allows companies to improve its risk profile from the ground up, laying the groundwork for other dimensions of diversification.

Figure 23: Other Types of diversification of industry diversified/specialist companies



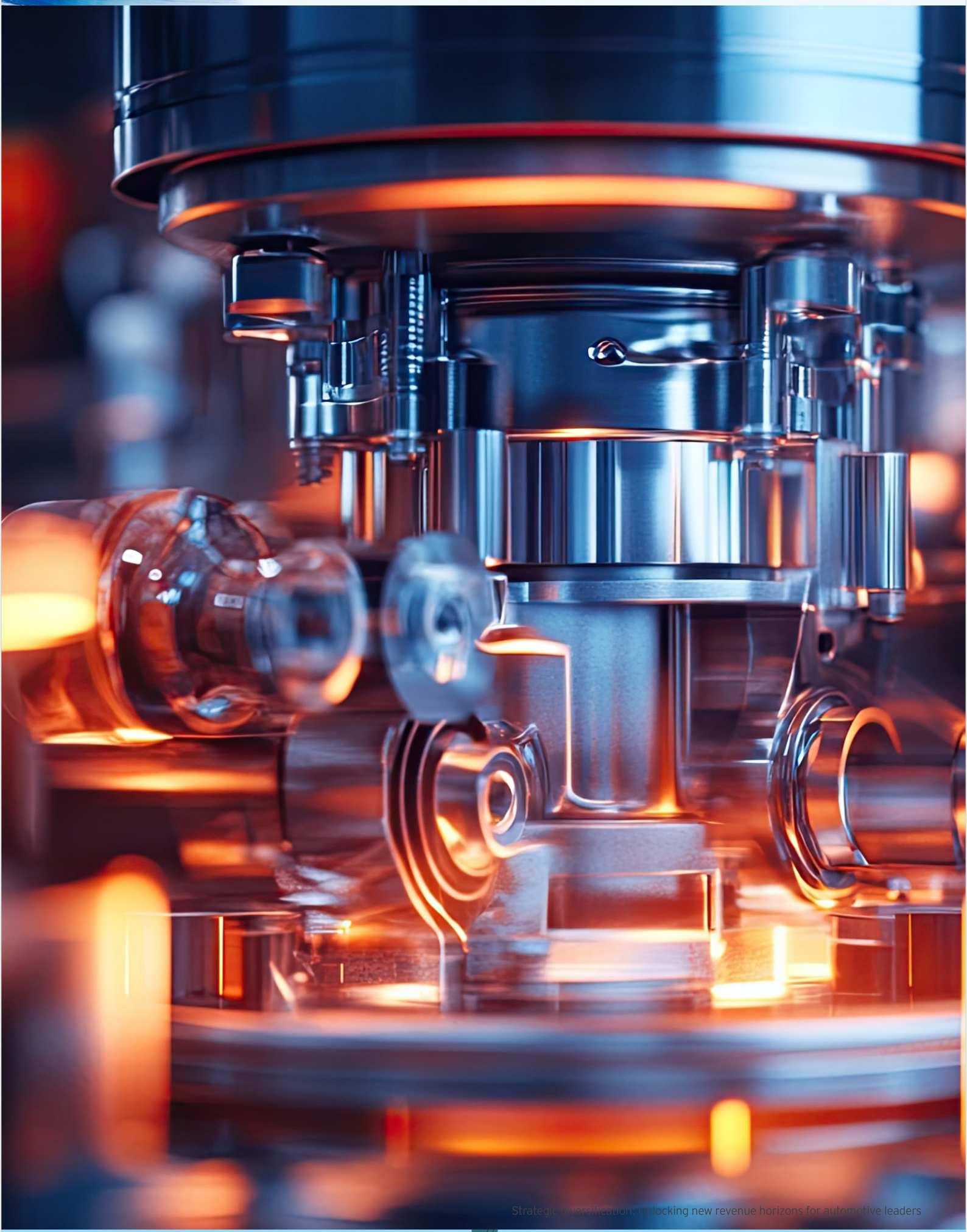
Key Insight:
Industry diversified companies are less likely to be capability, powertrain and customer or channel diversified. This suggests that although industry diversification can hedge against the cyclicity of the automotive industry, it does not in itself support diversification across other dimensions like capability diversification.

These patterns suggest that diversification is not a uniform strategy but a set of interlinked decisions. For many firms, capability expansion acts as a foundational move that unlocks further growth and risk mitigation opportunities. Others may adopt a more focused form of diversification, depending on their long-term strategic intent and resource allocation.

Insights: Summary

Diversification plays a central role in shaping both the growth trajectory and financial resilience of auto component companies, though its impact differs across types. Capability and powertrain diversification are most closely associated with faster topline growth, while geographic, industry and customer diversification tend to offer more stability by reducing exposure to external shocks. Profitability outcomes also skew in favor of diversified firms, which show stronger margins and significantly lower volatility—especially evident during disruptive periods like COVID-19.

One of the most striking patterns is the underperformance of large specialist firms, which face greater downside risks when competing with diversified peers at scale. This highlights that size alone is not a buffer—diversification becomes increasingly important as firms grow. Overall, the findings reinforce that diversification is not just a defensive strategy, but a critical enabler of sustained performance and long-term competitiveness in a rapidly evolving industry landscape.



Chapter 05

Getting it right: Best practices for diversifying effectively



Best practices and strategic imperatives for diversification

For India's auto component manufacturers, the last decade has redefined what it means to be competitive. Scale and cost leadership are no longer sufficient. The industry is being shaped by technological transitions, policy shifts, demand fragmentation, and rising external shocks. In this context, **diversification is no longer an optional growth strategy – it is a core pillar of risk management and future readiness.**

But not all diversification creates value. Done reactively, it can fragment resources and dilute focus. Done strategically, it becomes a source of resilience, margin stability, and sustained growth. For boards, promoters, and CXOs, the path forward lies in structured, capability-led diversification.

Five principles for effective diversification

Start with capability, not trend

Diversification works best when it extends what a company already does well. New businesses should be rooted in core engineering, manufacturing or material strengths–not just with market momentum.

Map risk, then spread exposure

The objective is not to do more–it is to reduce exposure. Leadership must first identify where their current risk lies: Is it product concentration? Customer dependency? Geographic exposure? Diversification should directly address those vulnerabilities.

Test, learn, then scale

Not every diversification bet will work. Pilots, technical partnerships or JV-led entries can help validate markets without large up-front investments. Treat diversification like R&D—experimental, data-led and iterative.

Invest in systems, not just markets

More product lines or regions mean more decisions. Companies that succeed at diversification have strong internal systems: cross-functional teams, clear governance and flexible supply chains. Operational maturity often determines whether diversification scales or stalls.

Let strategy also lead, not just opportunity

Diversification should serve the long-term vision. Chasing short-term demand blurs focus. Strategic discipline—in timing, target market, and execution—makes the difference between value creation and distraction.

Enablers that make diversification work

Successful diversification requires more than just intent—it requires execution muscle. Organizations are using a variety of strategic levers to enter new domains effectively:

- Technical collaborations and acquisitions to access capabilities quickly
- Customer co-development to reduce risk and facilitate product market fit
- Talent redeployment to seed new verticals with domain know-how
- Digital platforms to open direct-to-user channels or capture aftermarket demand

These enablers reduce execution risk, build organizational agility, and help keep diversification anchored in capability.

Final note: Building the future-ready supplier

India's component industry is at a crossroads. With rising global interest, policy support and supply chain rebalancing, there is immense upside potential – but only for companies that are ready to evolve. **The future belongs to suppliers who are not just efficient, but resilient. Not just capable, but adaptable.**

Diversification, when done with clarity and discipline, becomes the bridge to this future. It ensures that companies are not locked into a single market, a single customer or a single trajectory. It builds room to maneuver—and room to lead.



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Rewiring the Automotive Component Supply Chain: Navigating Disruption And Driving Resilience in a Multipolar World

By

FROST & SULLIVAN

White Paper

Rewiring the automotive component supply chain: navigating disruption and driving resilience in a multipolar world



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SECTION- I

SUPPLY CHAIN STRUCTURE

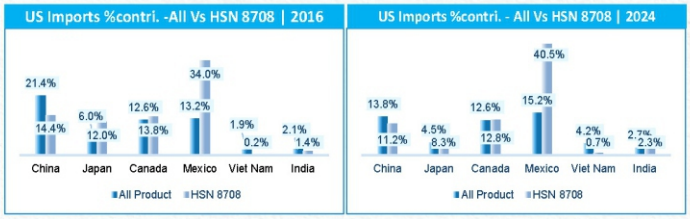
4

SUPPLY CHAIN STRUCTURE AND REALIGNMENT - GLOBAL

IMPACT OF US-CHINA TRADE WARS AND CHINA+1 STRATEGY (1/2)

The global auto component supply chain is undergoing a fundamental realignment due to geopolitical tensions, economic volatility, and shifts in global sourcing preferences. India, as a rising manufacturing hub, is significantly impacted by these macro-level changes.

- **Key sourcing countries included China, Mexico, and Germany**, known for brake systems, sensors, and HVAC units. However, the **share for Mexico, for instance, increase to ~ 38% - 40% in 2024 for US.**



Source ITC , US Census of Bureau statistics and Frost and Sullivan analysis Note : HSN 8708 contributes to ~55% of auto component

- **Favorable Tariff Differential:** India enjoys a 29% average tariff advantage over China across key categories, improving competitiveness in sectors like electricals, apparel, and vehicles.
- **India's Export Opportunity Window:** India is expected to gain in 22 out of 30 HS-2 product categories (covering 61% of its exports to the U.S.), due to tariff disadvantages faced by competitors China, Canada, and Mexico
- **India's Strategic Position:** India maintained a **modest 2.7% share** in the U.S. imports for the year 2024, making it less exposed and more favorably positioned.

Country	Reciprocal Tariff	Universal (10%)	Auto (25%) & Metals (50%)	Reciprocal (R)/ Punitive (P)
China	55%	Yes	Yes	20% (Fentanyl) + 25% (P)
Vietnam	46%	Yes	Yes	Paused (R)
Thailand	36%			
Taiwan	32%			
Indonesia	32%			
India	26%			
South Korea	25%			
Malaysia	24%			
Japan	24%			
EU	20%			
Singapore	10%			
Saudi Arabia	10%			
United Arab Emirates	10%			

1- The April 9 pause on reciprocal tariffs was not applicable to China.
2- The universal 10% tariff will not be applied on auto and metal imports, which face 25% and 50% tariffs, respectively.
3- Punitive tariffs are applied outside of reciprocal tariffs and only apply to China, Canada and Mexico.
Note – Data and analysis on this slide are updated as of June 2025

KEY TAKEAWAYS

India with its large and cost-competitive talent pool, is likely to remain a key manufacturing investment destination. Moreover , India's reciprocal tariff is lower than China's tariff driving India's export competitiveness. India must leverage its position by accelerating bilateral agreements, upgrading product standards, and targeting high-value categories like semiconductors and gas turbines.

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SUPPLY CHAIN STRUCTURE AND REALIGNMENT - GLOBAL

DISRUPTION IN CONTAINER TRADE, FREIGHT ROUTES, AND NEARSHORING TRENDS

Red Sea and Panama disruptions stretched lead times and reduced container capacity; while UNCTAD and canal updates show gradual recovery, WTO's 2025 outlook flags persistent uncertainty. India's expanding port ecosystem offers exporters resilience through re-routing and risk buffering

CONTAINER TRADE AND FREIGHT ROUTES

- **Red Sea/Suez:** By mid-2024, Suez tonnage and Bab-el-Mandeb flows dropped steeply; Cape of Good Hope detours became the "new normal" adding distance and time.
- **UNCTAD** estimates detours raised vessel demand ~3% and container-ship demand ~12%; As a result, the overall cost of living (global inflation) could rise by about 0.6 percentage points by the end of 2025 if elevated freight persists.
- **India maritime posture:** Government of India kept organizing and holding meetings for Red-Sea SIGs (Special Interest Groups) and advisories. India's major ports handled ~855 million tones of cargo in FY 2024–25, recording ~4.3% year-on-year growth, with container throughput expanding by nearly 10%. This resilience highlights the available headroom in port infrastructure to support re-routing strategies and staging of inventories, thereby strengthening India's positioning as a regional logistics hub.

Indicator	Exposure	Why it helps component exporters
Major Ports traffic (FY 2024-25)	~855 MT (+4.3% YoY); Containers throughput +10%	Gate/yard capacity and service levels can absorb re-routed TEUs (Twenty-foot Equivalent Unit)
Inland Waterways cargo (FY 2024-25)	145.5 MMT CAGR - 20.86%	Cost-effective domestic repositioning to ports during ocean volatility

STRATEGIC SOURCING MODLES

- **Dual Sourcing for EU demand (strategy) :** Adopt a dual-sourcing strategy for EU demand by positioning India as the primary supply base for HS 87XX categories, while simultaneously establishing strategic inventory hubs across the Netherlands, Poland, and Germany to de-risk supply continuity and buffer against transit volatility.
- **Why keep India primary for HS 87XX ? -** The EU's imports from India grew +9% in 2024 (all goods), confirming healthy capacity and commercial ties.
- India's major ports handled ~855 MT in FY 2024–25 (+4.3%), with container throughput +10%, indicating headroom to support stable export flows.
- **For auto components specifically, the EU supplier association CLEPA notes ongoing two-way EU - India component trade and lists HS 87XX as a priority line in its March 2025 position paper.**
- **North America (strategy):** To unlock duty and procurement advantages under the United States–Mexico–Canada Agreement (USMCA) Rules of Origin (ROO), OE-adjacent (Original Equipment–adjacent) bids should complete final assembly or finishing inside Mexico or the United States, so the parts qualify as North American in origin.
- **India's role (upstream):** India is a major exporter of auto components to North America. ACMA's latest performance review shows North America at ~32% of India's component exports and highlights export categories (drive transmission & steering, engine, suspension & braking, rubber, etc.)
- **India's role (aftermarket):** Focus on pre-kit aftermarket packs in India and export to US-West Coast /US- East Cost, since India's scale and cost base make sea freight far more economical than air for bulky, lower value-density parts.

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SUPPLY CHAIN STRUCTURE AND REALIGNMENT - GLOBAL

DISRUPTION IN CONTAINER TRADE, FREIGHT ROUTES, AND NEARSHORING TRENDS

Nearshoring means shifting production or sourcing to a country geographically close to the end market, rather than far-off locations. The goal is to cut lead times, logistics risk, and tariff exposure while keeping cost advantages and tighter coordination.



North America "Regionalization": **USMCA** rules push more content to be made within North America (e.g., 75% regional value content for vehicles, 70% steel & aluminium from North America, and 40-45% labor-value content at ≥$16/ hr). This structurally favors Mexico and U.S-based machining/assembly suppliers.



Mexico sits at the center of the U.S. parts trade: The U.S. Department of Commerce (International Trade Administration) notes Mexico is the largest export market for U.S. automotive parts and a top global producer, reflecting tight cross-border supply chains and just-in-time proximity advantages.



EU "de-risking" (not full reshoring): The EU is incentivizing cleaner/secure value chains at home while tightening sustainability/traceability; **CBAM** (Carbon Border Adjustment) applies first to inputs like iron/steel and aluminium (not finished auto parts), which still affects upstream sourcing choices.

WORKFLOW OF USMCA (UNITED STATES-MEXICO-CANADA AGREEMENT) COMPLIANT AUTO PARTS

India	Mexico	United States
India – Upstream Manufacturing (HS 8708) • Sub-components: castings/forgings, brakes, rubber-metal, housings • Docs: traceability, invoice, packing list, HTS HS 8708 • Quality: IATF 16949 / ISO; EDI-enabled ASN & labelling	**Mexico – IMMEX Finishing / Assembly** ▪ Light machining, sub-assembly, final finishing (adds NA content) ▪ USMCA ROO: lift RVC value ▪ Traceability capture for Certificate of Origin (CoO) ▪ 3PL shelter / contract manufacturing options under IMMEX	**United States – FTZ / Bonded Distribution Centre** ▪ Duty deferral/reduction; weekly entry; kitting/postponement ▪ EDI with OEM/aftermarket; QA inspection & VAS ▪ Rapid fulfilment to plants & dealer networks (1–3 days) ▪ COO issued; compliance & audit trail retained **Aftermarket Packs (Service)** • Pre-kitted SKUs (India) staged in FTZ/DC • Fulfillment to regional DCs / dealer network **OE-Adjacent Supply** • Meets USMCA ROO; qualifies for preferential duty • JIT/JIS/JIC deliveries from FTZ/DC; ASN visibility

Sources Various and Frost and Sullivan Illustration

KEY TAKEAWAYS

Indian suppliers should focus on adding finishing/assembly in Mexico [often via partner JVs or 3PL-run IMMEX (Industria Manufacturera, Maquiladora y de Servicios de Exportación) sites] to increase North American content, strengthen traceability/COO (Country of origin), and unlock duty and procurement benefits under USMCA.

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SUPPLY CHAIN STRUCTURE AND REALIGNMENT

GLOBAL VS LOCAL SOURCING TRENDS – KEY DESTINATION

India's auto component industry balances global and local sourcing to optimize costs, quality, and supply chain resilience. The China+1 strategy, US-China trade tensions, and India's FTAs have shaped sourcing trends.

Global Sourcing: Essential for high-tech components due to domestic capability gaps but exposes India to risks like semiconductor shortages (2020–23) and China's dominance in EV batteries.

Local Sourcing: Cost-competitive for traditional components but scaling up for EV components requires significant investment in R&D and technology transfer.

Global strategies

Aspect	Global Sourcing
Component Types	High-tech (ECUs, EV batteries, precision parts)
Cost	Higher (20–30% import duties, freight costs)
Key Destinations	China, Germany, Japan, South Korea, Thailand
Risks	Geopolitical disruptions, supply chain bottlenecks
Share of Sourcing	25% to 30%



Trend Shift: The China+1 strategy has increased sourcing from ASEAN (e.g., Thailand, Vietnam), while localization efforts aim to reduce import dependency to 20% by 2030

National strategies

Aspect	Global Sourcing
Component Types	Low-to-medium complexity (engine, chassis, brakes)
Cost	Lower (10–25% cost advantage)
Key Destinations	Tamil Nadu, Maharashtra, Gujarat
Risks	Technology gaps, limited scale of Tier 2/3 firms
Share of Sourcing	70% -75%

Source: IEA, IBEF, Frost and Sullivan Analysis

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EVOLVING ROLE OF COMPONENT MANUFACTURERS

THE ROLE OF INDIAN AUTO COMPONENT MANUFACTURERS IS SHIFTING FROM COMMODITY SUPPLIERS TO STRATEGIC PARTNERS IN THE GLOBAL SUPPLY CHAIN, DRIVEN BY TECHNOLOGICAL ADVANCEMENTS, THE EV TRANSITION, AND GLOBAL TRADE REALIGNMENTS.

From Suppliers to Technology Partners	Focus on EV Components	Digital Integration	Sustainability	Global Supply Chain Integration
• Tier-1 manufacturers are now expected to provide R&D, digital engineering, sustainability compliance, and post-sales service, often on a global scale	• 20% of Tier 1 suppliers are pivoting to produce EV motors, inverters, and sensors, driven by India's target of 30% EV penetration by 2030.	• Adoption of IoT, AI, and digital twins in manufacturing improves efficiency by 12–15%.	• Compliance with EU's CBAM and RoHS/REACH norms pushes manufacturers to adopt green practices, such as recycling 30% of materials and using renewable energy in 15% of operations.	• Indian firms are becoming tiered suppliers to global OEMs like Ford and Volkswagen, with 25% of exports integrated into global platforms for compact vehicles.



Challenges

TECHNOLOGY GAPS	1	Only 15% to 20% of Tier 2/3 suppliers meet global quality standards, limiting their role in high-tech supply chains.
SCALE LIMITATIONS	2	SMEs lack the capital to invest in EV component production, around 70% operating at below 50% capacity.
SKILL SHORTAGES	3	The transition to EV and smart manufacturing requires upskilling 1.5 million workers by 2030.

Source: Ministry of Commerce and Industry, Government of India., Journal and Media Publications , F&S Analysis

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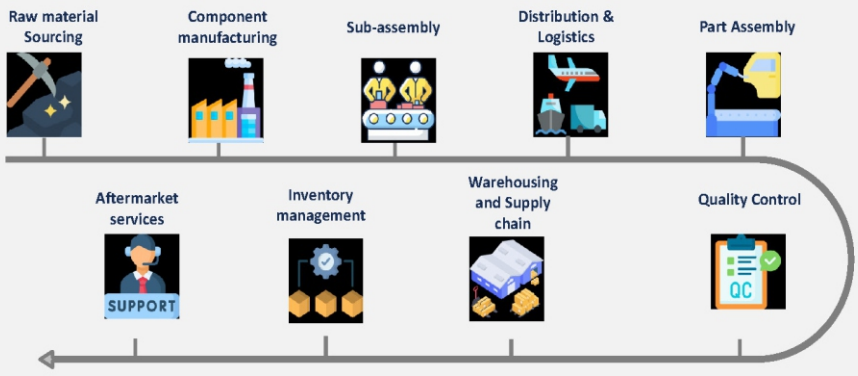
END-TO-END VALUE CHAIN OF COMPONENT MANUFACTURERS (1/3)

The auto component manufacturing value chain in India is a complex, multi-tiered ecosystem that spans raw material sourcing, production, assembly, and distribution. It involves a network of Tier 1, Tier 2, and Tier 3 suppliers, original equipment manufacturers (OEMs), and logistics providers.

OUR VIEW OF THE COMPONENT VALUE CHAIN



Key Stages	Challenges
Raw Material Sourcing	High import costs (20–30% for specialty materials), geopolitical disruptions.
Component Manufacturing	Technology gaps in Tier 2/3, compliance with global standards (RoHS, REACH).
Sub-Assembly	Dependence on imported high-tech components, skill shortages.
OEM Integration	Supply chain bottlenecks, inventory management inefficiencies.
Distribution & Logistics	Port congestion, high freight costs (20–30% increase due to Red Sea crisis).
Aftermarket Services	Counterfeit parts, fragmented aftermarket network.

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END-TO-END VALUE CHAIN OF COMPONENT MANUFACTURERS (2/3)

1. **Industry Evolution :** Transitioning from import substitution to high-tech, globally integrated manufacturing. Increasing focus on electronics, sensors, and EV-specific components.

2. **Value Chain Localization :** High localization in mechanical and chassis parts. Next frontier: Localization of electronic and EV components.

3. **Strategic Positioning:** Government policies and investment climate support: Indian policies and investment climate support both local champions and global integration, positioning India as a critical node in the world's auto supply ecosystem.

4. **Tiered Supplier Ecosystem:** Tier 1 suppliers (e.g., Bosch, Motherson Sumi) directly supply OEMs with complex assemblies, while Tier 2/3 suppliers produce sub-components like fasteners and gaskets. Approximately 70% of India's 10,000+ auto component firms are Tier 2/3, often small and medium enterprises (SMEs) with limited scale and technology.



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END-TO-END VALUE CHAIN OF COMPONENT MANUFACTURERS (3/3)

5. **Cost Dynamics:** Raw materials account for 60–65% of production costs, with steel and aluminum sourced locally (India is the world's second-largest steel producer), but specialty materials like lithium and cobalt are imported, increasing costs by 20–30%.

6. **Localization Push:** The Production Linked Incentive (PLI) scheme has increased domestic sourcing to 70% for low-to-medium complexity components, reducing reliance on imports for engine and chassis parts

7. **Capability Challenge:** Tier 2/3 suppliers face technology and quality gaps, with only 20% meeting global standards. Logistics inefficiencies, such as port congestion at Chennai and Mundra, add 10–15% to export costs



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SECTION- II

SUPPLY CHAIN OPTIMIZATION – KEY LEVERS

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SUPPLY CHAIN OPTIMIZATION – KEY LEVERS (1/2)

SUPPLIER DIVERSIFICATION AND LOCALIZATION DRIVE

In response to rising tariffs, geopolitical tensions, and supply interruptions, automotive component suppliers and OEMs are aggressively pursuing supplier diversification and localization strategies in 2025. These efforts aim to build resilient, cost-effective supply chains that mitigate risks from overdependence on single countries, particularly China.

Enablers

- **Diversification Efforts:** OEMs and Tier 1 suppliers are increasingly adopting multi-country sourcing. India, Mexico, and Southeast Asia are key beneficiaries, as companies seek to reduce tariff exposure and geopolitical risks.
- **Localization Trends:** Localization is accelerating, particularly in EV components like motors, control units, and battery systems. India currently localizes ~30% of its EV supply chain, with government incentives driving further expansion.
- **Export Growth and Market Penetration:** India's automotive component exports grew from approximately $7.4 billion in FY21 to $12.8 billion in FY24 (Niti Aayog). The US and Europe remain key export destinations, absorbing two-thirds of India's automotive component shipments.
- **Challenges in Substitution:** Despite efforts, India still imports about ~26% in FY25 of its auto components from China, especially niche and complex parts. Competitive cost structures and scale advantages presently favor Chinese suppliers, posing a substitution challenge.

Impact

Metric	Impact in Next 5 Years	Summary
% OEMs pursuing multi-country sourcing		Diversification reduces trade and tariff risks
% Localization of EV supply chain in India		Increasing self-reliance in critical components
Investment in Indian auto component capacity (Rs. crore)		Supports capacity expansion and upgradation
India's auto component exports (USD billion)		Reflects export growth and market penetration
% Auto component imports from China		Persistent import dependence challenges



SUPPLY CHAIN OPTIMIZATION – KEY LEVERS (2/3)

DIGITIZATION: IOT, BLOCKCHAIN, DIGITAL TWINS IN SCM

Digitization is a key supply chain optimization lever in automotive component manufacturing in 2025. Technologies such as the Internet of Things (IoT), blockchain, and digital twins are transforming supply chain visibility, transparency, risk management, and operational efficiency.

Enablers

- **IoT for Real-Time Tracking:** Connected sensors across factories, and supply chain networks enable continuous tracking of assets, equipment health, and environmental conditions. This supports predictive maintenance, reduces downtime, and strengthens supplier performance.
- **Blockchain for Transparency and Traceability:** The technology is increasingly employed to secure provenance, verify compliance (such as RoHS/REACH), and enhance trust across multi-tier suppliers.
- **Digital Twin Technology in Production:** Virtual replicas of production lines and vehicles allow real-time monitoring, scenario testing, and predictive analysis. Manufacturers use them to spot inefficiencies, forecast failures, and optimize processes, resulting in improved throughput and quality control.
- **AI and Advanced Analytics Integration:** AI-driven platforms integrate IoT and enterprise data to power predictive analytics, dynamic demand forecasting, and automated decision-making. These capabilities improve responsiveness, cut operating costs, and boost profitability for digitized supply chains

Impact

Metric	Impact in Next 5 Years	Summary
% OEMs and suppliers adopting IoT		Real-time monitoring and predictive maintenance gains
% OEMs using blockchain for traceability		Enhanced transparency and compliance
Digital twin market size (USD billion)		Simulation and optimization driving efficiency
Supply chain cost reduction via AI/digitization (%)		Operational savings and EBIT improvements



SUPPLY CHAIN OPTIMIZATION – KEY LEVERS (3/3)

PREDICTIVE DEMAND SENSING ,DYNAMIC REPLENISHMENT AND PACKAGING OPTIMIZATION

Predictive demand sensing and dynamic replenishment are revolutionizing the automotive component supply chain landscape. These technologies enable enhanced responsiveness to market fluctuations, improved inventory management, and minimized stockouts or excesses through advanced data analytics and real-time supply chain monitoring.

Enablers

- **Increased Vehicle Sensor Integration:** The automotive sensors market, crucial for demand sensing, is driven by increased electrification and autonomous vehicle technologies (e.g. NHTSA and GSR mandate in upgrading sensor-based feature in the vehicle by 2029)
- **Data-Driven Demand Forecasting:** OEMs and Tier 1 suppliers use predictive analytics powered by AI and IoT sensor data to extract accurate demand signals from sales, market trends, weather, and production data thus reducing the forecasting error and reduces inventory holding costs and lost sales.
- **Dynamic Replenishment and Inventory Optimization:** Dynamic replenishment models enabled by real-time data allow agile supply chain adjustments, reducing stockouts and excess inventory.
- **Packaging Innovations:** Advanced protective packaging materials such as anti-corrosion films, volatile corrosion inhibitors, and electrostatic discharge protection are widely adopted. Modular, stackable, and custom-fit packaging designs maximize space utilization and reducing warehousing and logistics costs.

Impact

Metric	Impact in Next 5 Years	Summary
Automotive sensors market size (USD billion)		Reflects investment in demand sensing tech
Forecast error reduction through AI (%)		Improved accuracy and cost savings
Inventory reduction via dynamic replenishment (%)		Decreases excess and obsolete stock
Stockout reduction (%)		Enhances service levels and customer satisfaction
Packing innovation		Stackable packaging for engine and transmission components



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SECTION- III

EV TRANSITION: IMPACT ON COMPONENT DEMAND AND SOURCING

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INDIA'S AUTO COMPONENT SUPPLY CHAIN: EV TRANSITION (1/2)



1. ICE VS. EV : TRANSFORMATION

Section	Key Points	Data / Figures	Implications
ICE vs. EV: Transformation	ICE: mechanical, 2,000+ parts → EV: <200 parts; 45–84% ICE parts obsolete by 2030–40	ICE: engines 30–40% cost; EV: batteries 40–50% cost	New opportunities in batteries, motors, power electronics; risks for legacy parts
Key Challenges	Low R&D (<3% vs. 6–10% global); skill gaps; localization rules (FAME II: 50% DVA)	By 2030: 30% EV penetration → +5.7% value addition	Firms must reskill & pivot



2. EV-SPECIFIC IMPORTS

Section	Key Points	Data / Figures	Implications
EV- Specific Imports	Import dependence high; localization 30–40% (motors/ controllers)	Imports ~$1.4B (2022–24); only 13% cell demand met domestically by 2030	Import reliance risks supply security
Import Sources	China (84%), SK/Japan (cells, semiconductor), EU/US (electronics)	PLI-ACC: 50 GWh domestic capacity by 2026	Need diversified sourcing



3. SHIFTING VALUE POOL

Section	Key Points	Data / Figures	Implications
Shifting Value Pool	EV pool expands vs. ICE	Global: $600B → higher-margin EVs; Electronics ~23% of EV BOM	Value shift toward powertrain, semiconductors, software
India's Potential	EV value chain = $76–100B by 2030; semiconductor ~$1,200 per vehicle; software = 4–5% cost	EV BOM +15–20% vs. ICE	New growth for local suppliers

KEY TAKEAWAYS

- India's auto component supply chain faces both disruption and opportunity—a shift from engine-focused to high-tech, electronic, and battery-based manufacturing.
- Strategic investments, government support, and upgraded supplier capabilities are positioning the country for long-term growth in the global EV landscape.

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INDIA'S AUTO COMPONENT SUPPLY CHAIN: EV TRANSITION (2/2)





4. IMPACT ON LEGACY SUPPLIERS

Section	Key Points	Data / Figures	Implications
Impact on Legacy Suppliers	Risks: 190+ ICE parts obsolete; 8M jobs affected	Auto sector = 7.1% GDP	Threat to pistons, valves, exhaust parts
Opportunities	Reskilling, exports (2Ws, electronics, batteries), recycling ecosystems	EV assembly requires 30–50% fewer parts	Pivot possible with retraining & exports

5. PARTNERSHIP MODELS

Section	Key Points	Data / Figures	Implications
Partnership Models	JVs (minerals, tech transfer), OEM–supplier ecosystems, MSME partnerships	JSW: $1.8B EV powertrain; Tata alliances; REASSERT recycling	Collaboration key to scaling
-	-	-	-

KEY TAKEAWAYS

This transition is fostering a collaborative supply chain ecosystem, encouraging knowledge sharing, technology joint ventures, and strategic alliances among OEMs, component makers, and tech firms—reshaping India's auto industry to meet the demands of the EV age.

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TRENDS IN THE INDIAN EV MARKET FOR 2025

Supply Chain Localization

India's focus on EV supply chain localisation is poised to significantly shape the industry's future, drive job creation, and ensure cost competitiveness, supported by robust public policy and widespread industry alignment.

Connected Features

India's EV market is swiftly transitioning toward software-defined, connected, and intelligent vehicles. As technologies like AI, 5G, ADAS, and seamless charging mature, EV ownership is becoming more convenient, personalized, and safe.

Interoperable Charging Network

The interoperable EV charging network in India is on the brink of a transformation—set to radically improve accessibility, convenience, and user trust in electric mobility.

Strategic Collaborations

- *Strategic collaborations are important for India's EV evolution—spanning manufacturing, infrastructure, financing, and innovation.*
- *As global players, startups, and governments forge alliances, India to steadily emerge as a manufacturing powerhouse and a viable, scalable market for electric mobility.*

Advancement in Battery Technology

- *Battery technology is the heartbeat of India's EV transformation.*
- *With progress across chemistry innovation, manufacturing, sustainability, and digital intelligence, India is positioning itself as a future-ready battery hub.*

UX IOT – Premium Feature in Mass EV

- *Mass-market EV UX and IoT in India are converging to create vehicles that feel familiar, yet smarter than ever before.*
- *Whether it's entry-level models simplifying range anxiety, mid-tier SUVs offering rich interface ecosystems, or IoT transforming vehicle monitoring and charging—Indian EVs to truly become intelligent, accessible tools.*

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CHANGING POLICIES

HOW HAVE INCENTIVE SCHEMES HELPED THE EVOLUTION OF INDIAN EV MARKET?

AIM: CONSUMER INCENTIVES → COMPONENT LOCALIZATION → GLOBAL COMPETITIVENESS

Scheme	April 2015 Budget – ₹ 795 Cr	April 2019 Budget ₹ 11500 Cr	2019 Onwards	2021 Onwards Budget – ₹44,000 Cr	2023 Budget – ₹57,000 Cr	2024 Budget – ₹10,000 Cr	2025 (FDI Based)
	FAME I (Early) adoption	FAME II (Mass Adoption)	State Level Incentives (Regional Support)	PLI Schemes *(Manufacturing Localization)*	PM eBUs Sewa	PM eDRIVE ((Commercial Vehicles, e2W & e3W)	Import Duty Incentive Policy (FDI – Entry to Premium OEM)

SCHEME →	FAME I	FAME II	PLI SCHEME	PM eBus Sewa	PM eDrive	Import Duty
Key Beneficiaries	Mahindra Electric, Hero Electric, Ather Energy	Tata Motors, Olectra Greentech, Mahindra, Omega Seiki, Piaggio, Ather, Hero Electric, Bajaj	Ola Electric, Tata Motors, Mahindra, Suzuki-Toshiba, Exide, Amara Raja, Reliance, Hyundai, MG Motor, VinFast	Tata Motors, Olectra, JBM Auto, Ashok Leyland, PMI Electro	Ola Electric, Ather, Bajaj, TVS, Hero Electric, Tata Motors	Tesla, BYD, VinFast, Mercedes-Benz, BMW, Kia, Hyundai

Expected Impact:

- Manufacturing Localization
- Export Competitiveness
- Supply Chain Security
- Reducing Import Dependance
- Development of Charging Infrastructure

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EV MANUFACTURING OUTLOOK

CAN INDIA BECOME A MANUFACTURING HUB OF EVS BY 2030?

Game Changers in EV Manufacturing

ARTIFICIAL INTELLINCE & MACHINE LEARNING	ENHANCE PRODUCT QUALITY
DIGITAL TWINS	ADVANCED BATTERY PRODUCTION
SMART ASSEMBLY LINES	IoT ENABLED LINES
3D PRINTING	PROTOTYPING
ADVANCED AUTOMATION	ADVANCED ROBOTICS

Game Changers in EV Techology

Advanced Battery Technology	Ultra fast charging
Battery Recycling	Battery Swapping Systems
Advanced Power Electronics	Inductive Charging
Shift towards 800V Architecture	Skateboard Platforms
Vehicle to Grid	New Business Models

Component Localization

- EV Assembly
- Electric Motors
- Battery Assembly
- Cell Production
- BMS, Power Elec.
- Charging Infra

METER KEY: LOW <20% — MEDIUM UP 60% — HIGH >60%

Current Challenges

- High dependency on battery raw materials Lithium, Nickel, Cobalt.
- Cell manufacturing capability is still in the nascent phase and will require time to mature.
- Limited R&D in alternate battery chemistries such as Solid-state, Sodium ion, Lithium sulfur etc.
- Battery management systems and power electronics still under development and heavy reliance on Chinese, Japanese and Korean companies.
- Overcoming the cost competition especially with Chinese OEMs.

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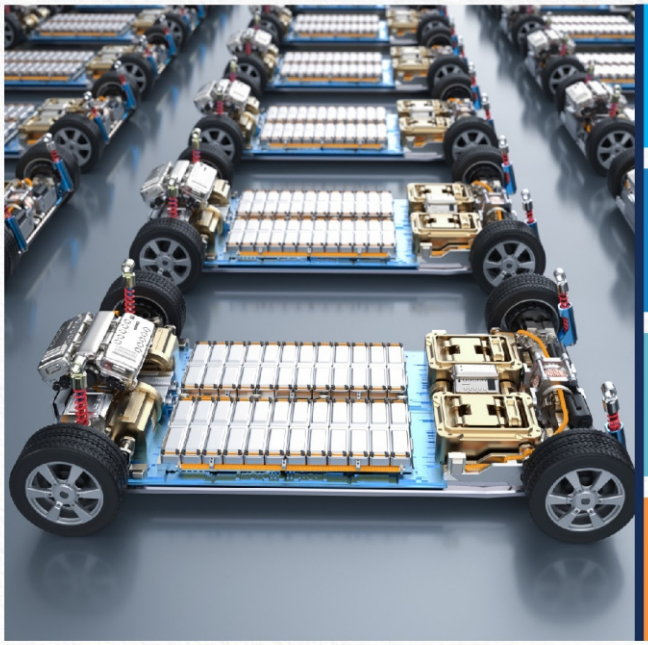
KEY TAKEAWAYS



- OEMs will focus on collaborating with domestic auto components manufacturers for battery packs, power electronics, and thermal systems to localize core EV system.
- The market will experience technology advancements that will ultimately drive innovations to achieve lower cost of vehicles.
- The market will continue to depend on the Chinese companies for battery technology mainly due to its expertise in the area.
- Import duty exemption on crucial battery components and production-linked incentive (PLI) schemes to drive domestic production capability.

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SECTION- IV

PERFORMANCE METRICS AND BENCHMARKING FRAMEWORK

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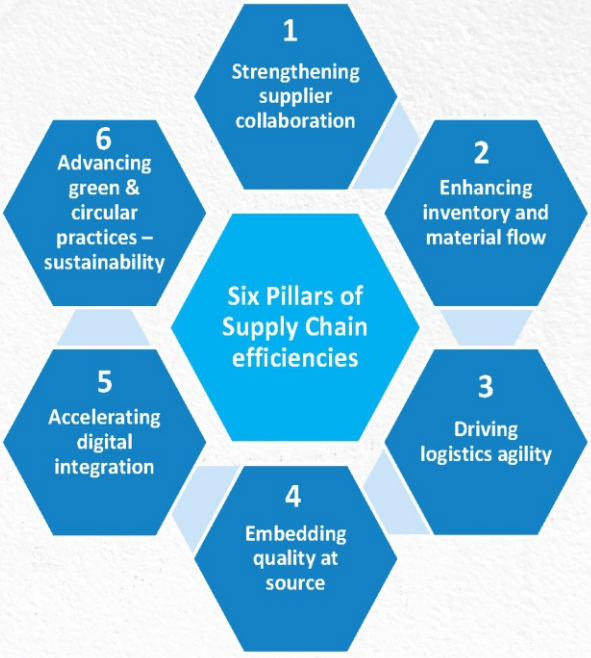
SIX PILLARS OF SUPPLY CHAIN EFFICIENCIES



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SIX PILLARS OF SUPPLY CHAIN EFFICIENCIES

PERFORMANCE METRICS AND BENCHMARKING FRAMEWORK (1/3)

PARAMETER	PERFORMANCE METRICS	BENCHMARKING FRAMEWORK
1. STRENGTHENING SUPPLIER COLLABORATION	• Supplier Diversification Ratio: Percentage of components sourced from multiple suppliers to reduce single-source risk (Target: >70% for critical components). • Collaboration Index: Frequency and effectiveness of joint planning sessions (e.g., monthly reviews with key suppliers). • Supplier On-Time Delivery Rate: Percentage of deliveries meeting agreed timelines (Target: >95%). • Supplier Quality Index: Defect rates in supplied components (Target: <1% defective parts).	• Best Practices: Adopt collaborative ecosystems like Maruti Suzuki's partnerships with DPIIT to foster innovation with suppliers. • Technology Enablement: Use blockchain for transparent supplier tracking, as seen in hyperledger fabric-based architectures improving traceability and reducing risks. • Global Benchmark: Compare with Japanese OEMs that use tiered supplier networks to ensure resilience and quality. • Actionable Steps: Implement supplier development programs, co-innovation workshops, and long-term contracts to align goals.
2. ENHANCING INVENTORY AND MATERIAL FLOW	• Inventory Turnover Ratio: Number of times inventory is sold/replaced annually (Target: 8-10 for automotive components). • Order Fulfillment Cycle Time: Time from order placement to delivery (Target: <48 hours for domestic OEMs). • Material Flow Efficiency: Percentage of materials moving without delays (Target: >90%). • Inventory Quality Ratio (IQR): Proportion of usable inventory (Target: >98%)	• Best Practices: Leverage IoT for real-time inventory tracking, as Indian automakers are doing to preempt equipment failures and manage stock. • Technology Enablement: Integrate intelligent ERP systems with Big Data and IoT for predictive inventory management, reducing excess stock by 10-15%. • Global Benchmark: Compare with German automakers (e.g., Volkswagen) using digital twins for seamless material flow across 124 plants. • Actionable Steps: Adopt just-in-case inventory strategies, streamline warehouse operations with Industry 4.0, and use AI-driven demand forecasting

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Source: Industry Journals, Industry Benchmarks Research Papers, F&S Analysis

SIX PILLARS OF SUPPLY CHAIN EFFICIENCIES

PERFORMANCE METRICS AND BENCHMARKING FRAMEWORK (2/3)

PARAMETER	PERFORMANCE METRICS	BENCHMARKING FRAMEWORK
3. DRIVING LOGISTICS AGILITY	• Logistics Cost as % of Revenue: Target <8% to remain competitive. • Delivery Lead Time: Time from dispatch to delivery (Target: <24 hours for domestic, <5 days for exports). • Freight Utilization Rate: Percentage of transport capacity utilized (Target: >85%). • Agility Index: Time to reroute logistics in disruptions (Target: <12 hours)	• Best Practices: Use smart logistics (e.g., IoT-enabled real-time tracking) to reduce mean waiting times at factories, wholesalers, and retailers. • Technology Enablement: Implement AI and cloud computing for predictive maintenance and route optimization, as seen in leading Indian automakers. • Global Benchmark: Emulate Tesla's agile logistics model, which uses real-time data to optimize global supply chains. • Actionable Steps: Diversify transport modes (e.g., rail and road), adopt nearshoring to reduce lead times, and invest in cybersecurity to protect logistics data.
4. EMBEDDING QUALITY AT SOURCE	• First Pass Yield (FPY): Percentage of components meeting quality standards without rework (Target: >95%). • Defect Rate: Defects per million units (Target: <100 DPM). • Quality Audit Compliance: Percentage of processes meeting ISO/TS 16949 standards (Target: 100%). • Customer Complaint Resolution Time: Time to resolve quality issues (Target: <48 hours).	• Best Practices: Integrate quality checks at supplier and production stages, as seen with Bharat New Car Assessment Program (BNCAP) driving cutting-edge component quality. • Technology Enablement: Use AI-driven analytics for real-time quality monitoring and predictive maintenance. • Global Benchmark: Compare with Bosch's quality systems, which invest USD 58.11 million in R&D for high-performance components. • Actionable Steps: Implement Six Sigma methodologies, train suppliers on quality standards, and use blockchain for traceability to ensure defect-free sourcing

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Source: Industry Journals, Industry Benchmarks Research Papers, F&S Analysis

SIX PILLARS OF SUPPLY CHAIN EFFICIENCIES

PERFORMANCE METRICS AND BENCHMARKING FRAMEWORK (3/3)

PARAMETER	PERFORMANCE METRICS	BENCHMARKING FRAMEWORK
5. Accelerating Digital Integration	• Digital Adoption Rate: Percentage of processes digitized (Target: >80% by 2028). • System Downtime: Hours of IT system unavailability annually (Target: <10 hours). • Data Accuracy Rate: Accuracy of supply chain data (Target: >99%). • ROI on Digital Investments: Return on digital transformation projects (Target: >20% within 2 years).	• Best Practices: Adopt Industry 4.0 technologies like digital twins and IoT • Technology Enablement: Use AI, cloud computing, and blockchain for end-to-end supply chain visibility, as Indian automakers are implementing for real-time tracking. • Global Benchmark: Compare with leading OEMs's smart factories, which integrate IoT and analytics for predictive maintenance. • Actionable Steps: Invest in ERP interoperability, train workforce on digital tools, and prioritize cybersecurity to protect digital systems
6. ADVANCING GREEN AND CIRCULAR PRACTICES – SUSTAINABILITY	• Carbon Footprint Reduction: Percentage reduction in CO2 emissions (Target: 20% by 2030). • Recycled Material Usage: Percentage of components using recycled/bio-based materials (Target: >30% by 2028). • Energy Efficiency: Energy consumption per unit produced (Target: <0.5 kWh/unit). • Circular Economy Index: Percentage of components recycled/reused (Target: >25% by 2030).	• Best Practices: Adopt sustainable materials like biodegradable interiors and lightweight aluminum alloys • Technology Enablement: Use blockchain for tracking recycled material usage and IoT for energy-efficient production, as proposed in hyperledger fabric architectures. • Global Benchmark: Compare with BMW's circular economy initiatives, targeting 50% recycled materials by 2030. • Actionable Steps: Invest in green manufacturing (e.g., renewable energy in factories), align with BS-VI norms, and partner with firms who offer sustainable packaging.

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Source: Industry Journals, Industry Benchmarks Research Papers, F&S Analysis

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SECTION- V

DISRUPTION DRIVERS AND ECOSYSTEM CHALLENGES

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DISRUPTION DRIVERS AND ECOSYSTEM CHALLENGES

TIER 2/3 CAPABILITY GAPS AND SCALE ISSUES

Tier 2 and Tier 3 automotive component suppliers continue to face significant challenges due to capability gaps and scale limitations, which are exacerbated by evolving product complexity, digitalization demands, and stricter regulatory and compliance standards (e.g. IATF 16949, PPAP, APQP) required by OEMs



Drivers / Challenges	Global Impact	Domestic Impact
Scale Limitations: Smaller suppliers often lack production scale and technological investments to satisfy larger OEM contracts and volume consistency. Only about 70% of Tier 2/3 suppliers meet scale and capacity needs demanded by global OEMs, leading to supply fragility and prompting OEMs to consolidate or develop suppliers.		
Supplier Development Programs: To address these issues, OEMs and Tier 1 suppliers have invested significantly in programs that upskill Tier 2/3 suppliers, focusing on process innovation, quality enhancement, and digital capability building.		
Impact on Supply Chain Resilience: The capability deficits in Tier 2/3 suppliers are a major cause of supply disruptions, especially amid shifting regional sourcing models driven by tariffs and geopolitical risks. Companies with mature supplier networks and robust development efforts are better positioned to mitigate supply chain vulnerabilities		
Complex Compliance Across Jurisdictions: Compliance is difficult due to fragmented supplier data, different regional requirements, and shifting regulations. For example, the EU's Batteries Regulation requires transparent and auditable sustainability reporting, including digital product passports for electric vehicle components. This necessitates massive data consolidation efforts across multiple supplier tiers.		
Sustainability and Human Rights Due Diligence: Enforcement of laws like Germany's Supply Chain Due Diligence Act and the EU Corporate Sustainability Due Diligence Directive is rising, compelling automakers to ensure human rights and environmental standards across entire supply chains, including sub-tier suppliers. Transparency into raw material sourcing for EV batteries (nickel, cobalt) to avoid forced labor or environmental violations is a major.		



Source: Frost & Sullivan Analysis

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DISRUPTION DRIVERS AND ECOSYSTEM CHALLENGES

EMERGING PORT & ROAD INFRASTRUCTURE IN INDIA

India is rapidly emerging as a strategic hub for automotive component manufacturing and export, supported by significant improvements in port and road infrastructure. These enhancements are key enablers helping India capitalize on the global trade realignment driven by new reciprocal tariffs, including those imposed by the US.



Port Modernization and Expansion India's major ports such as JNPA (Nhava Sheva) and Chennai, are undergoing mechanization, digitalization, and road/rail connectivity upgrades. As a result, average turnaround time at major ports improved to 48.06 hours in FY2023-24 (from 93.59 hours in 2013-14). Recent NICDC-LDB (Logistic data bank) data also show double-digit reductions in container dwell times (~14% Pan-India, ~22% at JNPA for rail-bound imports), which supports shorter logistics lead times for export supply chains, including automotive.



Automotive Clusters Linked by Infrastructure: Regions like Maharashtra, Tamil Nadu, Gujarat, and the National Capital Region have seen clustering of automotive component manufacturers along these improved transport corridors, allowing better scale economies and supply chain synchronization.



Dedicated Freight Corridors & Expressways: Government programs - DFC and Bharatmala are streamlining freight flows and improving port hinterland connectivity. NITI Aayog projects ~80% cuts in rail transportation time on DFCs (25→~70 km/h average speeds), while MoRTH/PIB corridor sheets record large road travel-time reductions (e.g., 24 →12 h, 18→8 h, 4→2 h). These time/speed gains support Just-in-Time (JIT) delivery models for automotive components and align with the Government's objective to lower logistics costs.



Government Investment and Support: In FY 2024–25, the Government allocated substantial funds for port and logistics upgrades—e.g. INR 700 cr for Sagarmala, INR 1,010 cr capital for IWAI, and INR 70 cr for Development of Minor Ports, taking targeted port and waterways infrastructure well above INR 1,500 cr. In parallel, the PLI-Auto (INR 25,938 cr) and PLI-ACC (INR 18,100 cr) schemes incentivize investments in advanced auto-component manufacturing and related ecosystems.

IMPACT ON SUPPLY CHAIN RESILIENCE

Infrastructure improvements significantly bolster India's capability to serve as a competitive global sourcing hub for automotive components, supporting the industry's ambitious growth targets and helping mitigate tariff impacts through improved logistics efficiency. Enhanced port and road networks contribute directly to India's rising share in global automotive component exports and enable manufacturers to optimize just-in-time production models

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SECTION- VI

KEY PROFILES: GLOBAL LEADERS IN COMPONENT SUPPLY CHAIN

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KEY PROFILES: LEADERS IN COMPONENT SUPPLY CHAIN (1/3)

BOSCH LTD.

Market Position

- **Bosch Ltd., established in 1951**, is a leading Tier 1 supplier with a strong Indian and international footprint in engine parts, brakes, electronics, and mobility solutions.
- **Bosch supports** OEMs like Maruti Suzuki, Tata Motors, and Mahindra with 16 manufacturing sites across India

Key Drivers of Supply Chain Efficiency

- **Digitalization:** Bosch leverages IoT and automation in plants for real-time inventory and production monitoring, using systems like Connected Industry and Bosch Production System.
- **Lean Manufacturing:** Just-in-time delivery, advanced demand forecasting, and flexible scheduling enhance operational efficiency.
- **Supplier Integration**: E-procurement platforms and integrated supplier management allow prompt and transparent transactions

Building Supply Chain Resilience

- **Risk Management:** Bosch conducts regular supplier audits and implements strong risk mapping to anticipate disruptions.
- **Local Sourcing:** Focuses on strengthening regionally diverse supplier bases, reducing import dependency and customs risks.
- **Inventory Optimization:** Critical part consignment warehouses facilitate fast, reliable replenishment

Collaboration & Sustainability

- **Green Initiatives:** Bosch pursues zero-emission manufacturing and has committed to carbon-neutrality at its Indian plants by 2025.
- **Supplier Codes:** Strong adherence to environmental and ethical guidelines for all suppliers.
- **Cross-Industry Alliances:** Collaborative projects on low-carbon logistics and smart energy management

Source: Company Website, Industry journals, Media Interviews of Company Executives, F&S Analysis

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KEY PROFILES: LEADERS IN COMPONENT SUPPLY CHAIN (2/3)

BHARAT FORGE LTD.

Market Position

- **Bharat Forge Limited** is a leading Indian auto component manufacturer specializing in forgings, chassis components, and diversified products for automotive, aerospace, and industrial sectors, with operations in 10 countries, over 20 manufacturing facilities, and a workforce of approximately 5,000 employees.
- **The company emphasizes** sustainable supply chain practices, including comprehensive supplier assessments to ensure resilience and innovation, aligning with ESG goals

Key Drivers of Supply Chain Efficiency

- **Digital Transformation**: Bharat Forge integrates advanced ERP systems, digital twins, and AI-driven logistics forecasting to optimize operations, resulting in a 22% increase in supply chain efficiency.
- **Operational Improvements**: Post-pandemic normalization has eased constraints, enhancing resource efficiency and stakeholder engagement in supply chain processes.
- **Innovative Practices**: Focus on yield improvements, cost management, and strategic sourcing to drive productivity and quality across the value chain

Building Supply Chain Resilience

- **Strategic Agility**: The company traces antecedents of resilience through practices like strategic agility and adaptability from inception, enabling robust response to disruptions.
- **Diversification and Localization:** Benefiting from global supply chain shifts, subsidiaries like JS Auto report revenue growth; emphasis on localized sourcing to mitigate risks.
- **Risk Mitigation**: Investments in supply chain resilience, including emergency plans and diversified vendor networks, to handle volatility and ensure continuity

Collaboration & Sustainability

- **Sustainable Supply Chain:** Implements responsible practices, extending sustainability criteria to partners for alignment, quality feedback, and innovation. •
- **ESG Integration**: Comprehensive assessments of suppliers for environmental and social impacts, fostering a resilient and eco-friendly ecosystem.
- **Collaborative Efforts**: Partnerships for training and development, promoting shared goals in efficiency and sustainability across the supply chain.

Source: Company Website, Industry journals, Media Interviews of Company Executives, F&S Analysis

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KEY PROFILES: LEADERS IN COMPONENT SUPPLY CHAIN (3/3)

UNO MINDA

Market Position

- **Uno Minda is a prominent Indian** auto component major offering lighting, switches, sensors, and EV systems, with over 70 manufacturing plants, operations in 20+ countries, and a workforce exceeding 20,000.
- **The company integrates sustainability into its supply chain**, focusing on ESG assessments of partners and localization to build resilience

Key Drivers of Supply Chain Efficiency

- **Digital Integration**: Implementation of the Vista system connects CRM with costing, and product development systems for real-time visibility and agile turnarounds.
- **Lean Practices:** Adopts lean manufacturing, advanced technologies, and data-driven decisions to optimize processes and reduce waste.
- **Training & Optimization:** Comprehensive programs to minimize errors, enhance safety, and improve operational efficiency.

Building Supply Chain Resilience

- **Diversification & Localization:** Expands vendor base across geographies and focuses on local sourcing to mitigate geopolitical and natural disaster risks.
- **Risk Assessments:** Regular evaluations of market conditions and emergency response plans to ensure continuity.
- **Adaptability:** Modular products and diversified offerings to handle market shifts and supply disruptions

Collaboration & Sustainability

- **Green Supply Chain:** Promotes cleaner practices, reducing emissions, water usage, and waste through supplier collaborations.
- **ESG Compliance:** Thorough assessments and Supplier Code of Conduct covering human rights, labor, and environmental standards
- **Renewable Transition:** Targets 60% renewable energy by 2023, carbon neutrality by 2024, and net zero by 2025

Source: Company Website, Industry journals, Media Interviews of Company Executives, F&S Analysis

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SECTION- VII

OPPORTUNITIES FOR COMPONENT MANUFACTURERS

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HOW INDIAN AUTO COMPONENT MANUFACTURERS CAN LEAD GLOBAL SUPPLY CHAIN

INDIAN AUTO COMPONENT MANUFACTURERS CAN LEAD THE GLOBAL SUPPLY CHAIN BY LEVERAGING COST ADVANTAGES, FOCUSING ON ADVANCED MANUFACTURING, EXPANDING GLOBAL PARTNERSHIPS, EMBRACING NEW TECHNOLOGIES, AND CAPITALIZING ON SUPPORTIVE GOVERNMENT POLICIES

KEY STRATEGIES FOR GLOBAL LEADERSHIP

- India is becoming a global auto manufacturing hub, driven by low costs, skilled labor, and PLI incentives, as global firms adopt a "China+1" strategy to diversify supply chains, particularly for EV components.

TECHNOLOGICAL ADVANCEMENTS AND QUALITY STANDARDS

- Manufacturers to invest in technology, precision engineering, and global quality standards to supply high-value auto components.
- Strong focus should be on R&D in green mobility and electrification; as India is positioning itself as a hub for future-ready automotive technologies.

EXPORT GROWTH AND MARKET REACH

- With North America and Europe as primary destinations, Indian firms should build resilient, diversified supplier networks, making India a reliable hedge against global supply chain disruptions.

POLICY SUPPORT AND INFRASTRUCTURE

- Encouraging joint ventures, technology transfers, and global partnerships to increase India's integration into global value chains.
- The combination of policy support—such as financial incentives FDI approval in auto parts—along with infrastructure development (smart cities, manufacturing parks), will bolster India's ability to compete globally and lead supply chain transformations.

ESSENTIALS FOR GLOBAL SUPPLY CHAIN LEADERSHIP

FACTOR	HOW INDIA LEADS	KEY SUPPORT
Cost Efficiency	Competitive manufacturing costs	Skilled workforce, scale
Technology & Quality	High-value component exports	R&D, standards compliance
Policy & incentives	PLI, FDI, localization	Investor-friendly environment
Market diversification	China+1 strategy, global OEM shift	Strategic partnerships

IN SUMMARY

- Indian auto component manufacturers can lead the global supply chain by leveraging cost advantages, focusing on advanced manufacturing, expanding global partnerships, embracing new technologies, and capitalizing on supportive government policies.

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KEY STRATEGIES TO ACHIEVE GLOBAL LEADERSHIP

1 ADVANCE TECH.

- **Invest in Advanced Technologies** – adopt automation, IoT, AI, and data analytics to improve productivity and quality.
- **Precision Engineering** - enhance capabilities in high-value, critical components (e.g. EV parts, ADAS/ C-V2X, power electronics).

2 R&D & INNOVATION

- Focus on R&D and Innovation.
- **Green Mobility** - Invest in electric vehicle (EV) components, lightweight materials, and battery tech.
- **Collaborate with Academia & Startups** - Drive innovation through partnerships in emerging tech.

3 GLOBAL PRESENCE

- Expand global presence.
- **Strategic Acquisitions & JVs** - acquire or partner with international companies to access new technologies and markets.
- **Localize Abroad** - set up manufacturing or R&D centers in key global auto hubs (e.g. Europe, NA, ASEAN).

4 ROBUST SUPPLY CHAIN

- Build robust supply chains.
- **Resilience & Diversification** - develop multiple sourcing and logistics partners to reduce risk.
- **Digital Supply Chain** - Use tech for real-time monitoring, forecasting, and inventory optimization.

5 UPSKILLING

- Consider Skilling and Talent Development.
- **Upskill Workforce** - Train employees in new technologies, automation, and global best practices.
- **Leadership Development** - Build global-ready managerial and technical talent.

6 BRANDING

- Branding and Global Marketing an important aspect.
- **Position as High-Tech Suppliers** - Shift from "low-cost" to "high-quality, innovation-driven" perception.
- Participate in global platforms to ensure visibility.

STARTEGIC ROADMAP

Short Term (0 – 1 year)

- Begin adoption of Industry 4.0 technologies in pilot plants.
- Acquire key global certifications.
- Leverage government PLI schemes and export incentives.
- Initiate workforce upskilling programs.
- Build visibility through participation in global trade events.

Medium Term (1 – 3 years)

- Expand R&D capabilities for EV components and green mobility.
- Forge partnerships with academia and startups for innovation.
- Establish global offices or small-scale R&D units in strategic markets.
- Strengthen digital supply chain systems.

Long Term (3 – 5+ years)

- Scale precision engineering.
- Execute strategic global acquisitions or joint ventures.
- Achieve brand positioning as a premium, innovation-driven supplier.
- Set up full-fledged manufacturing units abroad.
- Sustain leadership in future-ready technologies. (e.g. C-V2X, battery tech, hydrogen, flex fuel, SDV's etc.)

IN SUMMARY

- For Indian auto component manufacturers to lead the global supply chain, they must move beyond being cost-effective suppliers and position themselves as strategic, high-value partners to global OEMs and Tier-1s. Success will depend on moving up the value chain, embedding innovation, and operating with global mindset and standards.

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POSSIBLE OPPORTUNITIES - HOW WILL RISING EV DEMAND RESHAPE INDIA'S EXPORT MIX BY 2030

RISING EV DEMAND WILL DRAMATICALLY RESHAPE INDIA'S EXPORT MIX BY 2030, SHIFTING FOCUS FROM TRADITIONAL INTERNAL COMBUSTION ENGINE COMPONENTS TO HIGH-VALUE ELECTRIC DRIVETRAIN, BATTERIES, AND ELECTRONICS, AND POSITIONING INDIA AS A MAJOR SUPPLIER IN THE GLOBAL MARKET.

OPPORTUNITIES IN EV COMPONENTS		
EXPORT CATEGORY	**KEY DRIVERS**	**MAJOR MARKETS**
Batteries & Packs	Local manufacturing, PLI	US, EU, SEA
Motors & Drivetrains	OEM ties, R&D	Europe, NA, Asia
Power Electronics	Cost, quality, innovation	Global
Telematics & Software	IT sector strength	Worldwide
Charging Hardware	Infrastructure scale	Emerging markets

KEY TAKEAWAYS

1. With expanding domestic expertise and OEM partnerships, electric traction motors, integrated drivetrains, and related assemblies (e-axles, reducers) will be key export items.
2. Exports of EV controllers, inverters, battery management systems, and advanced charging components are set to surge, leveraging India's electronics manufacturing base and cost advantages.
3. India's IT capabilities position it strongly to export telematics hardware, connectivity modules, and embedded vehicle software for smart, connected, and autonomous EVs globally.
4. India is ramping up production of AC/DC chargers, connectors, and related charging infrastructure, expected to supply both domestic deployment and international markets.

IN SUMMARY

- India's export mix will become increasingly dominated by advanced EV components, solidifying its role in global value chains and generating large-scale employment and investment opportunities.
- Components with significant electronics content—such as battery cells, controllers, and telematics—will outpace exports of engine and transmission parts and may drive new investment and production capacity across India's auto component sector.

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1 SUPPLY CHAIN STRUCTURE
2 SUPPLY CHAIN OPTIMIZATION – KEY LEVERS
3 EV TRANSITION: IMPACT ON COMPONENT DEMAND AND SOURCING
4 PERFORMANCE METRICS AND BENCHMARKING FRAMEWORK
5 DISRUPTION DRIVERS AND ECOSYSTEM CHALLENGES
6 KEY PROFILES: GLOBAL LEADERS IN COMPONENT SUPPLY CHAIN
7 OPPORTUNITIES FOR COMPONENT MANUFACTURERS
8 KEY TAKEAWAY- OVERALL



SECTION- VIII

KEY TAKEAWAYS - OVERALL

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GOVERNMENT FACILITATION OF AUTO COMPONENT ECOSYSTEM

CATEGORY	CATEGORY	CATEGORY
INCENTIVES AND FUNDING	• **Production Linked Incentive (PLI) Scheme :** Rs 25,938 crore budget (FY'23-27) to boost advanced technology manufacturing • **Faster Adoption and Manufacturing of Electric Vehicles (FAME-II) :** Rs 2,671 crore allocated in 2024-25 budget, with an additional Rs 1,500 crore approved in January 2024 for extension. • **Potential new scheme :** Rs 13,000 crore to enhance local production and reduce imports. • **PLI for Advanced Battery Chemistries :** To develop upstream Li-ion battery capabilities.	• Drives investments (e.g., $5.2 billion FDI in 2022) • Job creation (additional 65 million jobs projected) • Localization of EV components (Batteries, motors, power electronics)
POLICY FRAMEWORK	• **Make in India :** Encourages domestic manufacturing and integration into global value chains (GVCs). • **Automotive Mission Plan (AMP) 2026/2047:** Aims to elevate GDP contribution to over 12% and position India as a global hub. • **Vehicle Scrappage Policy and PM e-Bus Sewa :** Promote fleet renewal and EV adoption • **100% FDI under automatic route :** Attracts foreign investment in auto components.	• Enhances › Supply chain stability › Reduces import dependency › Supports SME integration into global ecosystems
REGULATORY AND STANDARDS	• **Bharat Stage VI (BSVI) Emission Standards :** Equivalent to Euro VI, expedited for environmental compliance. • **Bharat New Car Assessment Program (BNCAP) :** Strengthens safety and innovation in components. • **Real Driving Emission (RDE) Testing and On-Board Diagnostics (OBD)**	• Forces › Supply chain upgrades for advanced tech. › Improving global competitiveness and sustainability
INFRASTRUCTURE AND SUPPORT	• **Brownfield large-scale auto clusters :** Development incentives for existing hubs • **Support for startups/SMEs :** Funding and integration aid • **Testing and tooling infrastructure :** Viability gap funding via public-private partnerships (PPPs)	• Builds › Resilient ecosystems › Addresses talent gaps through reskilling, and facilitates R&D

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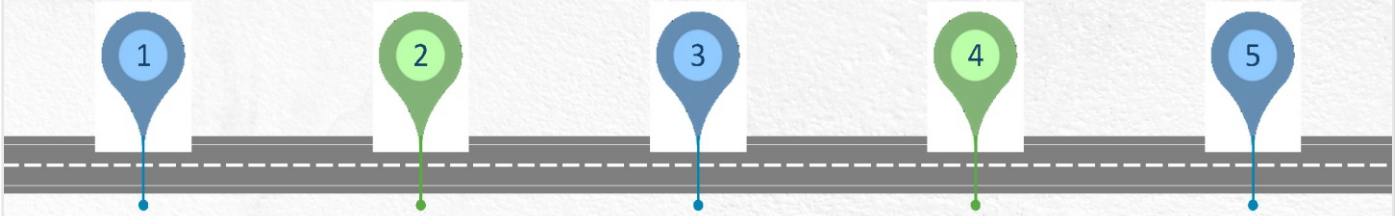
WAY FORWARD



1 POSITION INDIA AS A GLOBAL HUB	2 ENHANCE RESILIENCE AND DIGITALIZATION	3 PROMOTE SELF-RELIANCE AND IMPORT SUBSTITUTION	4 GLOBAL INTEGRATION	5 TALENT AND COLLABORATION FOCUS
• Attract global OEMs/Tier-1s with tailored incentives, single-window clearances, and shared warehousing in markets like the US and Europe. • Leverage supply chain shifts through nearshoring and demand aggregators. • Government can facilitate outreach via roadshows and subsidies for sustainability compliance (e.g., EU CBAM).	• Invest in AI, IoT, and Industry 4.0 for predictive analytics, reducing offshore procurement by 18% to 20% through nearshoring and diversifying suppliers. • Prioritize cybersecurity and skill development, with majority of CEOs viewing generative AI as key for growth.	• Focus on critical technologies like e-Drives, hydrogen systems, and automotive software through partnerships and PLI extensions. • Government incentives for raw materials and R&D hiring to reduce import reliance.	• Negotiate FTAs with EU, US, and ASEAN for market access; enhance "Made in India" branding through digital marketing. • Explore M&A and alliances for technology integration and advancement.	• Elevate supply chain roles with executive training and industry-led curricula. • Encourage consortia for SMEs to scale exports and innovate.

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Navigating Freight Disruptions in India's Auto Sector

By

Grant Thornton | 90 in Bharat and beyond

Grant Thornton | 90 in Bharat and beyond

#GTBharat SHAPING VIBRANT INDIA

Navigating freight disruptions in India's auto sector

Geopolitics, ports and pathways



Introduction

As India progresses toward its target of becoming a USD 7 trillion economy by 2030, the scale of trade continues to expand. In FY25, India's total exports reached USD 820.93 billion while total imports amounted to USD 915.19 billion, representing significant trade volumes that demand strong logistics frameworks capable of handling international trade[1].

The freight and logistics sector represents the system, which facilitates the movement of goods that underpins every aspect of economic activity from agriculture to e-commerce. While freight encompasses the physical transportation of goods across road, rail, air, and maritime networks, logistics constitutes the broader system of inventory management, warehousing, packaging, and delivery. The logistics sector serves as the vital link connecting production zones with consumption centres, supporting diverse industries.

The logistics industry contributes approximately 13-14% to India's GDP while providing employment to 22 million people, positioning it as both a substantial economic contributor and a major source of livelihood across the nation[2]

Currently, India's modal split for freight movement reveals significant dependence, with road transportation dominating at 66% of total freight movement (measured in tonne km), while railways account for 31%, shipping handles 3%, and air freight comprises less than 1%[3].

India’s automotive sector demonstrates how effective logistics infrastructure can significantly boost industrial performance. Logistics has become a critical enabler for the Indian automotive sector and **contributed to its 7.3% growth in FY25[4].**

India’s automotive vehicle industry is a vast and interconnected ecosystem encompassing the design, manufacturing, distribution, and servicing of motor vehicles and their components. The automotive sector contributes 6.8% to the overall GDP and nearly 40% to the manufacturing GDP. With an estimated turnover of USD 240 billion (INR 20 lakh crores), the sector stands as a cornerstone of industrial growth. In terms of employment, it supports around 30 million jobs[5].

So overall. India’s automotive sector represents an intricate relationship between manufacturing growth and supply chain dependencies. Growing by 7.3% in FY25 shows potential for rapid growth when supported by robust logistics infrastructure. However, beneath this impressive growth lies a web of dependencies that highlights the strategic importance of supply chain resilience and domestic manufacturing capabilities.

India's growing auto market continues to depend heavily on imported components and raw material, creating a complex dependency structure that encompasses multiple continents and countries.

Understanding the specific nature of these import-export relationships, including which components India sources from abroad, which markets it serves through exports, and how geopolitical events impact these trade flows becomes critical for examining both current risks and future growth potential. The following analysis examines these dependencies in detail, mapping the critical supply chains that underpin India's automotive success.

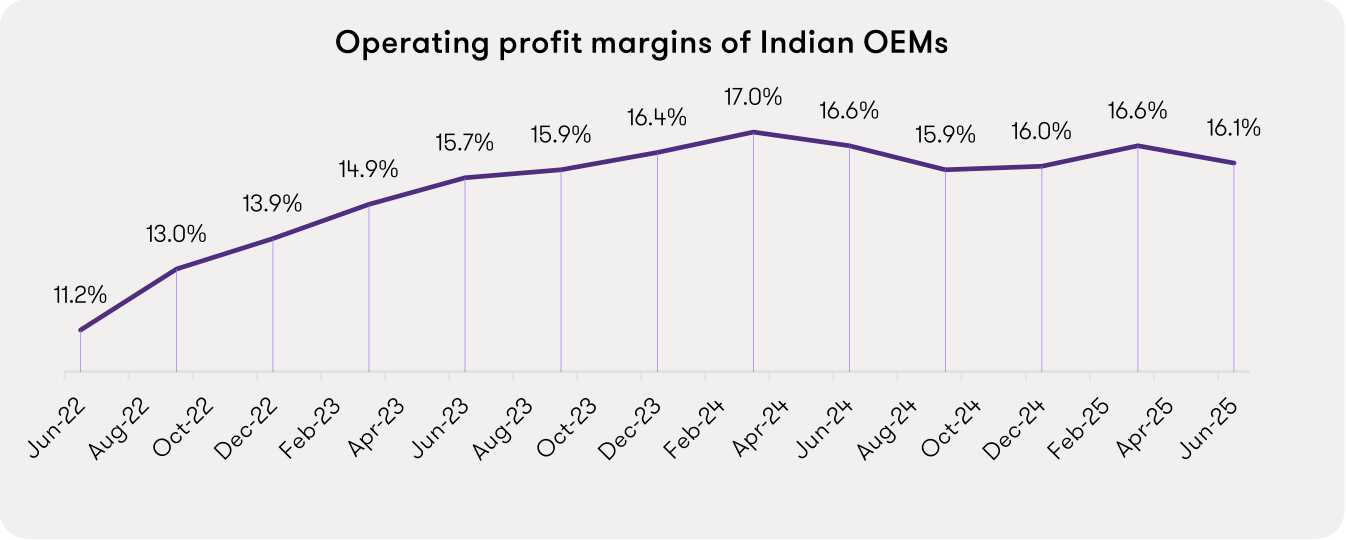
[1] Press Release:Press Information Bureau
[2] Press Note Details: Press Information Bureau
[3] Envisioning the future of Indian logistics @2047
[4] ETAuto
[5] SIAM Annual Report 2024.cdr

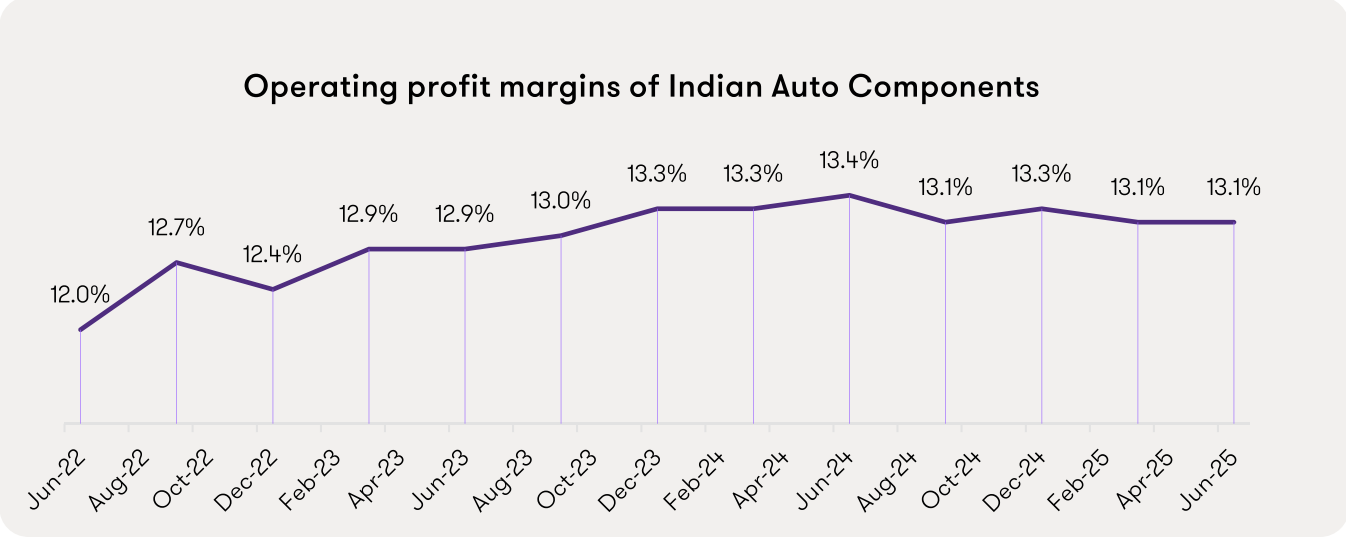
India's automotive supply chain: Vulnerabilities and dependencies

The Indian automotive industry is heavily dependent on imports and exports. India's automotive industry is expanding both domestically and globally, with significant exports to markets across **Asia, America, and Europe.** India is also dependent on regions like **China, Europe, and Japan** for imports of auto components and critical materials like rare earths.

Overall, there has been a marginal increase in the percentage of freight costs to total revenue in the auto-component industry, from freight costs as a percentage of total revenue increasing from ~4.7% to over 4.8%. The global supply chain vulnerabilities have compressed margins, especially for companies with high export volumes or global supply chains.

The graphs below highlight the quarter-on-quarter analysis of operating profit margins for Indian OEMs and Auto-components.





Export dependence and market exposure

India's automotive industry has emerged as a **global exporter of both vehicle components and finished vehicles, demonstrating sustained growth and rising competitiveness.** In FY24, automotive component exports grew to USD 21.2 billion, a 5% increase from the previous year. Geographically, Europe accounted for 33% of these exports, North America 32%, and Asia 24%. The most exported categories were drive transmission and steering components, which comprised 34% of the total, followed by engine components at 19%. Europe witnessed the strongest value increase, largely due to expanded economic ties with the UK, France, and Germany[6].

In addition, India has also significantly scaled up exports of finished vehicles. In FY24, total exports reached 4.5 million units. This included 672,000 passenger vehicles, 65,000 commercial vehicles, 300,000 three-wheelers, and a dominant 3.4 million two-wheelers. Two-wheelers were notably driven by demand in Africa, Latin America, and Southeast Asia. Despite occasional fluctuations, this diversified export portfolio has enabled the industry to withstand challenges from global market disruptions[7].

This growing export footprint highlights India's rising competitiveness in the global automotive landscape. However, to sustain and expand this momentum market diversification will be key, alongside supportive trade policies and resilient supply chain strategies.

Import dependence

While India's automotive exports are growing rapidly, it remains significantly dependent on imports for critical components and technologies. In FY24, this reliance was evident in the steady rise in import volumes and values.

In FY24, India's automotive component imports stood at USD 20.9 billion, registering a 3% growth over the previous year. Asia remained the largest source, contributing 66% of total imports, followed by Europe at 26%. Among individual countries, China was the top exporter, accounting for approximately 30% of India's component imports, while Germany ranked second with an 11% share.

Component-wise, body/chassis and steering systems, as well as engine parts, collectively formed 41% of total automotive imports. Beyond routine parts, Japan is a prominent supplier of high-value automotive technologies and maintains a stable trade relationship with India, further diversifying the import basket.

On the raw materials front, China represents a critical supplier. India is heavily reliant on China for its supply of rare earth elements. Despite having some reserves domestically, India lacks the processing and refining infrastructure needed to convert raw ores into usable materials, making imports essential. China supplies elements such as neodymium, dysprosium, lanthanum, and cerium. These elements are crucial for EV motors, catalytic converters, and electronic systems in vehicles.

Recent export restrictions by China on rare earth elements and permanent magnets have created supply chain disruptions, particularly for India's electric vehicle segment. These constraints have led to shortages, with automakers reportedly managing just weeks of supply in some categories.

India's growing exports shows positive signs but its dependence on imports pose strategic risks. To ensure long-term competitiveness, India must invest in local manufacturing, and diversified supply chains.

Tier 1 and Tier 2 supplier challenges

In the automotive supply chain, Tier 1 suppliers work closely with OEMs and supply them with complete systems or major components, such as engines and transmission systems. Whereas Tier 2 suppliers work with tier 1 suppliers and supply them with sub-components or raw materials, such as castings and forgings.

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[6] ACMAEXIMReportFY24.pdf
[7] SIAM Annual Report 2024.cdr

- **Supply chain sustainability and responsibility:** Tier 1 and Tier 2 suppliers face mounting pressure to align with global sustainability standards, particularly around Scope 3 emissions, those generated by upstream vendors and downstream logistics. OEMs are increasingly using sustainability metrics into supplier evaluations, pushing suppliers to adopt low-carbon technologies, ethical sourcing, and circular economy models.

  For example: A major OEM has revealed that they have developed a stringent supplier code of conduct to guide suppliers to engage in ethical, responsible, and legal business practices in their operations. This code is signed by more than 90% of their suppliers[8].

- **Overdependence on geography or key customers:** Many supplies face risk due to concentration in specific geographies or reliance on a limited number of customers. This overdependence exposes them to disruptions from regional events, such as political instability, natural disasters, or regulatory shifts and creates vulnerability in case of demand fluctuations or strategic pivots by key customers. To de-risk this overdependence, many suppliers are starting to diversify their customer bases. For example, a key Tier 1 supplier stated that they have reduced their dependence on any single customer to less than 10%[9]. Some suppliers are focusing on local sourcing, one major player stated that over 80% of components sourced locally, which has helped control costs and reduce import reliance.

- **Cost pressures:** Suppliers are squeezed between rising input costs (raw materials, energy, labour) and OEM demands for price reductions. Suppliers face limited pricing power and are often forced to absorb cost shocks without passing them on. Copper prices have seen a significant uptick due to increased usage in electric vehicles (EVs), renewable energy, and grid expansion projects.

- **Labour shortages and talent gaps:** Labour shortages have also been a significant issue, with the automotive sector's reliance on skilled labour becoming even more pronounced. Tier 1 & 2 suppliers struggle to recruit and retain skilled workers, especially in software engineering, data analytics, and advanced manufacturing roles. The shortage is driving wages higher, increasing labour costs and complicating efforts to scale new technology production.

Tier 1 and Tier 2 suppliers find themselves caught between the demands of maintaining cost competitiveness, developing sustainable practices while managing immediate profitability pressures, and attracting skilled talent while operating in an increasingly constrained labour market.

While these internal supply challenges present significant operational hurdles, they are further complicated by external geopolitical forces that lie beyond the direct control of automotive manufacturers and suppliers.

The automotive sector's reliance on imported components reflects broader patterns observed across various industries, where global supply chain integration leads to increased efficiency but also increase vulnerabilities in the form of supply chain disruptions. Recent geopolitical scenarios have illustrated these vulnerabilities, for example China's restriction on exports of rare earth elements has brought to attention how political decisions can instantly transform supply chain dynamics. These restrictions have affected import dependent manufacturers of automobiles.

Impact of geopolitical disruptions on global trade routes

The current geopolitical landscape presents a complex scenario with developments across key regions directly impacting India's logistics and supply chains. The following is an analysis of routes across the world which have been impacted and examines critical geopolitical developments and their specific implications for India.

[8] BSE
[9] BSE

- **Tariffs:** Tariffs have a direct impact on Indian automobile industry. When tariffs are imposed on imported components, critical materials like rare earths, or finished vehicles, they increase the cost of goods, thus inflating production expenses for OEMs and auto component manufacturers. This leads to higher procurement costs, which can compress operating margins, especially for companies heavily reliant on global supply chains. Eg, the recent imposition of a 25% import tariff by the United States on Indian auto components and tyres has created substantial headwinds for Indian exporters. The US accounts for 27% of India's auto component exports and 17% of tyre exports, making this a critical market[10]. As a result, Indian exporters are expected to face a revenue hit of INR 2,700–4,500 crore, with operating margins projected to decline by 150–250 basis points for exporters and 50–100 bps across the industry[11].

  From a logistics standpoint, tariffs force OEMs to restructure supply chains, which often leads to longer transport routes, increased freight costs, and the need for higher inventory buffers to manage uncertainty.

- **Red Sea crises:** The Red Sea crisis, which began in late 2023, stems from escalating attacks by Iran-backed Houthi rebels in Yemen targeting commercial vessels transiting the Bab el-Mandeb Strait: a critical maritime chokepoint linking the Red Sea to the Suez Canal[12]. These assaults, have disrupted one of the world's busiest shipping corridors, prompting major carriers to reroute vessels around the Cape of Good Hope, adding significant time and cost to global logistics chains[13]. Recent developments include the sinking of two merchant vessels: Magic Seas and Eternity C, by Houthi forces in July 2025, resulting in multiple crew fatalities and reigniting fears of a renewed maritime crisis[14]. The automotive industry has been significantly affected. European manufacturers have paused production due to delayed component shipments, particularly EV batteries sourced from Asia. Shipping detours have extended transit times by up to 20 days and increased freight costs by over 40%, creating issues in supply chains and inflating operational expenses. Delays are not the only issue associated with shipping parts and vehicles around Africa to avoid the Red Sea. The 3,000 extra miles travelled by ship means they burn more fuel[15]. India's automotive sector is also experiencing ripple effects. Key industry players acknowledged logistical challenges and cost escalations due to rerouting, though it expects minimal disruption to export volumes[16]. Another important name in this industry has reported delays in deliveries and supply chain constraints, with recovery anticipated in subsequent quarters[17]. Two-wheeler exporters are facing doubled freight rates and extended shipping times to Latin America and Africa, key markets for Indian manufacturers[18].

[10] Media sources
[11] Media sources
[12] Media sources
[13] Media sources
[14] Media sources
[15] Media sources
[16] Media sources
[17] Media sources
[18] Media sources

Impact on critical global trade routes

The geopolitical disruptions have created significant disruptions in key maritime corridors, fundamentally altering global shipping patterns and costs. The following analysis examines the specific impact on three critical waterways that are vital to India's trade.

- **Suez Canal:** The Suez Canal crisis is the ongoing disruption of maritime traffic through the Red Sea and Suez Canal. This strategic waterway connects the Mediterranean Sea to the Red Sea, forming a very lucrative shipping corridor between Europe and Asia[19]. It allows vessels to bypass the lengthy route around the Cape of Good Hope at Africa's southern tip, reducing travel time by up to 30%. The canal is crucial for global trade, handling nearly 12% of worldwide cargo and 30% of container traffic[20]. For India, it's especially important as approximately 20–25% of the country's foreign trade, including automotive components, crude oil, chemicals, and finished vehicles, passes through the Suez Canal. Indian automakers rely on this route to export vehicles to Europe, Africa, and the Middle East.

  The crisis has forced major shipping lines to reroute vessels around the Cape of Good Hope, adding 12–15 days to delivery timelines and increasing freight costs by up to 30%[21]. This has strained India's automotive supply chains, particularly for just-in-time manufacturing models that depend on timely imports of components.

  Exporters are also facing delays and reduced volumes, especially for low-value products such as two-wheelers and auto parts. While some Indian OEMs have adapted by choosing alternate routes, the longer transit times and elevated costs are impacting margins and production schedules.

- **Panama Canal:** Adding to these challenges, tensions have emerged over control of the Panama Canal, with various stakeholders expressing concerns about operational control and international influence. The Panama Canal connects the vast Atlantic Ocean with the Pacific Ocean through the Isthmus of Panama (land link from the border of Costa Rica to the Colombian border). It is an invaluable economic asset as it connects two water bodies and avoids the lengthy route around the Cape Horn.

  This strategic route serves over 180 shipping lanes and links nearly 2,000 ports across 170 countries. It handles about 2.5% of global maritime trade and is especially vital for transporting consumer goods, energy products, and automotive components. For India, the canal plays a key role in facilitating exports and imports of vehicles, parts, and raw materials, particularly those for markets in North and South America.

  Indian automakers rely on the canal for exporting vehicles and importing components like semiconductors, lithium, and rare earth magnets used in electric vehicles. The crisis has forced shipping lines to reroute vessels around the Cape of Good Hope. This has strained just-in-time manufacturing models and led to inventory shortages, production delays, and reduced export volumes, particularly for low-margin products like two-wheelers and auto parts.

- **Strait of Hormuz:** The Strait of Hormuz, between Iran and Oman, hosts around a fifth of the world's crude and LNG which passes through its narrow waters[22]. Following recent regional military activities, concerns have been raised about potential disruptions to this critical waterway. Although it remained operational, market uncertainty had already impacted shipping costs and routing decisions. Freight rates surged, vessels were rerouted, and insurers began tacking on war-risk premiums.

  India, which relied heavily on Gulf oil, faced the repercussions. Higher fuel prices drove up logistics costs for manufacturers. Critical components and materials used in EVs continued to move through Gulf trade routes, risking delays and inflated production costs.

[19] Suez Crisis: 1956, Cold War & Summary | HISTORY
[20] Media sources
[21] Media sources
[22] Media sources

Even exports faced delays and extra insurance fees, adding pressure on bottom lines. India is currently looking into alternative crude sources like Russia to increase imports.

These geopolitical disruptions are reflected in the operating margins of Indian OEMs and auto components manufacturers.

The recent geopolitical developments show how external forces can rapidly transform India's automotive supply chain landscape, creating both immediate and long-term strategic operational challenges. The simultaneous disruption of multiple trade routes from the Red Sea to the Taiwan Strait demonstrates the interconnected nature of global supply chains and India's vulnerability to events occurring thousands of kilometers away. These events have impacted the cost and availability of critical raw materials and auto components. Rise in logistics costs squeeze profit margins of Indian auto industry, especially those companies which are dependent on imports.

While these geopolitical tensions have exposed critical dependencies on specific regions and shipping corridors, they have also accelerated India's recognition of the need for supply chain diversification and domestic manufacturing capabilities.

India's ability to respond to these geopolitical shocks depend and capitalise on emerging opportunities depends on its logistics infrastructure. And ports are a major source of logistics connectivity in India.

Port and shipping infrastructure in India

Beyond supplier and trade dependencies, the efficiency of India's port infrastructure plays a critical role in enabling seamless automotive exports and imports. As global trade volumes rise, the capacity, connectivity, and reliability of port operations become vital to maintaining supply chains.

Overview

India is amongst the largest maritime countries in the world, with over 7,500 kms of coastline spanning 13 maritime states and union territories and geographically located at the centre of the Indian Ocean. India's coastline anchors 13 major ports and over 200 minor ones. The major ports are administered by the Ministry of Ports, Shipping and Waterways, whereas non-major ports fall under the jurisdiction of State Maritime Boards of respective state governments, including private ports operating under the public–private partnership (PPP) model.

In the fiscal year 2022–23, major ports handled 54.6% of the total cargo, while the remaining 45.4% was managed by non-major ports[23]. Among the 217 non-major ports, cargo is actively handled at only 68 ports, while the rest are primarily used by fishing vessels and ferries. Notably, 143 of these ports are located on the west coast, with Maharashtra and Gujarat alone accounting for 96 ports collectively.

To support the growth of the ports sector, the Indian government permits up to 100% Foreign Direct Investment (FDI) under the automatic route for port and harbour development. From April 2000 to September 2024[24], the port industry received INR 14,237.96 crore (US $ 1,637.30 million) in FDI. In the Union Budget 2025–26, the Ministry of Ports, Shipping and Waterways was allocated INR 2,470 crore, which accounts for 0.048% of the total budget[25].

By 2030, 85% of cargo at major ports is projected to be handled by PPPs and private operators. A pipeline of 46 PPP projects worth INR 63,000 crore has been identified for implementation between FY2024-25 and 2028-29.

[23] Non major ports study
[24] PTI
[25] Ministry of Ports, annual report (2024-25)

Current capacity

India's maritime infrastructure stands as a cornerstone of its economic development, supported by a robust network of major and non-major ports, strategic policy initiatives, and increasing private sector participation.

Approximately 95% of the country's trade by volume and 68% by value is moved through maritime transport, underscoring its critical role in India's logistics and trade ecosystem. As of 2023–24, the capacity of major ports stood at 1,629.86 MMT, with 819.29 MMT of cargo handled during the same period. Looking ahead, there is an aspiration to quadruple total port capacity to 10,000 MTPA by 2047, reflecting the scale of India's maritime ambitions[26].

During 2023–24, both major and non-major ports in India collectively handled a total cargo throughput of around 1,540.34 million metric tonnes, marking a 7.5% increase from 1,432.84 MMT in 2022–23. This growth was primarily driven by strong performance in iron ore, raw fertiliser, coking coal, and container shipments[Error! Bookmark not defined.].

Zooming into the performance of major ports, from April to December 2024, they handled 621.760 MMT of traffic. Within this, the POL category—which includes crude oil, petroleum products, and LPG/LNG—accounted for 184.57 MMT, maintaining the highest share among all commodities since FY 2017–18[Error! Bookmark not defined.].

In terms of individual port performance during the same period:

- Paradip Port recorded the highest traffic at 109.517 MMT.
- Deendayal Port followed closely with 108.724 MMT.
- Kolkata Port had the least traffic, handling 11.276 MMT[Error! Bookmark not defined.].

Operational efficiency also varied across ports. The average turnaround time for all the ports was 50.41 hours during April-December 2024, the highest being for Kolkata port at 82.48 hours, and the least was Jawaharlal Nehru Port at 26.67 hours, indicating better efficiency.

India's maritime sector continues to demonstrate strong growth, with increasing cargo volumes, expanding port capacities, and consistent improvements in operational efficiency. However, disparities in turnaround times and traffic volumes across ports suggest underlying challenges that need to be addressed. Identifying and resolving major bottlenecks will be crucial to sustaining this growth trajectory.

Major bottlenecks

Despite the promising growth of India's maritime sector, the logistics cost remains high (14% of GDP) as compared to the global benchmarks (8-9% of GDP). This in turn reflects the inherent issues and challenges facing the sector, which have dragged down operational efficiency and inflated logistics cost. This is also reflected in the Logistics Performance Index where India ranked 38th out of 139 countries.

Port congestion: Port congestion in India has been a growing issue in recent years due to a combination of factors such as increased cargo volume, limited infrastructure, and bureaucratic inefficiencies.

The development plan for ports India can be described as "port before road" approach, although with increase in trade volumes the capacity of the ports can be increased, this same development may not be seen outside the port in the form of ancillary infrastructural upgrades. Due to this the cargo must pass through congested city roads, this leads to delays in cargo

[26] Investor presentation, publicly listed company

handling and increased costs for both importers and exporters. In India**, 63% of shipments are delayed** due to port congestion[27].

Underutilisation of port capacity: India's major ports had a combined capacity of 1,629 million MMT in FY24, but actual cargo handled was only 819.29 MMT during FY2023-24. This indicates close to **50% utilisation,** pointing to inefficiencies in cargo movement, scheduling, and infrastructure deployment.

Infrastructural challenges: Non major ports in India often face challenges due to inadequate support infrastructure and limited integration with ancillary government institutions, which hampers basic access and efficient operation. A key issue is connectivity, many of these ports lack essential road and rail links needed for smooth cargo movement to and from hinterland regions. For instance, **Pipavav Port** in Gujarat, which became operational in 1998, was only recently connected to the national highway network, highlighting the slow pace of infrastructure development in some areas.

They also suffer from insufficient cargo handling capacities such as berthing facilities, berth numbers, and sufficient length for proper berthing of the vessels[28].

Unbalance modal mix: India relies heavily on road transport (60%), while rail (30%), shipping (3%) and air transport (1%) are underutilised. This leads to higher logistics cost which stands at **14%** as compared to global **8-10%** and underutilisation of rail, inland waterways, and shipping despite them being more cost effective and environment friendly.

Workforce related issues: Labour related challenges continue to disrupt port operations. In 2024, major ports averted a potential strike through wage negotiations, with unions initially demanding a 10.6% wage increase before settling for 8.5%. The All-India Port Workers' Federation reached agreements with port authorities, but labour disputes remain a recurring threat[29].

While these bottlenecks present significant challenges to India's logistics sector, Indian shipping companies and logistics providers play a major role in tackling these challenges through incessant investments, technological innovations and operations improvements. Their role extends beyond mere facility management to encompassing comprehensive solutions that tackle congestion, reduce turnaround times, and enhance overall port productivity.

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Operating ports: Major private port operators play a pivotal role in strengthening India's port infrastructure. The largest among them operates 15 ports across both coasts, with a combined capacity exceeding 630 MMT. This includes India's busiest commercial port and a key container handling hub. The second-largest operator manages 10 ports and terminals, with a total capacity of around 177 million tonnes.

02

Enhancing port efficiency: Shipping companies invest in new vessels and charter additional ships to boost capacity for example, the Shipping Corporation of India in 2024 acquired five second-hand container vessels and chartered ships to increase capacity by 9,000 TEUs (twenty-foot equivalent unit), directly addressing shortages and bottlenecks.

Logistics providers help streamline operations with technology, process improvements, and digital platforms, which have led to container dwell times dropping to just 3 days on average at major ports, as compared to 4 days in countries like the UAE and South Africa, 7 days in the US and 10 days in Germany

[27] Media sources

[28] Non major ports study

[29] Media sources

03

Hinterland connectivity: By investing in and supporting the development of multi-modal logistics parks and better road/rail links to ports, logistics providers ensure that cargo can be seamlessly moved between ports and the economy's interior. This integration reduces delays and improves supply chain reliability. Government initiatives like Bharatmala, Sagarmala and PM Gati Shakti have accelerated infrastructure development, directly involving private logistics and shipping companies.

04

Modernising port infrastructure: Shipping and logistics firms have championed digitisation, AI, and blockchain, improving process efficiency and transparency in port operations. Public-private partnerships have driven investments and innovation, leading to world-class infrastructure upgrades in cargo terminals, warehousing, and handling equipment.

Shipping companies and logistics providers are foundational to India's port infrastructure ecosystem. Their contributions stretch from operating a vast array of ports driving technological modernisation, tackling congestion, improving hinterland connectivity, and fostering efficiency across supply chains. These companies continue to elevate India's ports as drivers of economic growth, competitive export capacity, and integrated national logistics.

As Indian shipping companies and logistics providers drive improvement in port infrastructure, we need to turn attention to the dynamics of freight costs and pricing. The interplay of global market forces, supply chain volatility, regulatory changes, and evolving consumer demand is making freight cost management a central concern for both service providers and cargo owners. Understanding the recent trends and causes of volatility is essential to comprehending the broader challenges and opportunities that lie ahead.

Freight cost volatility and economic impact

Freight cost volatility has emerged as a critical challenge for India's automotive industry, driven by global disruptions such as the Russia–Ukraine conflict, Red Sea shipping delays, and domestic fuel price fluctuations. India's logistics costs are estimated to be 30% higher than those in China and other major markets, largely due to fragmented infrastructure and over-reliance on road transport.

Trends in freight rates and insurance premiums: Freight cost volatility arise due to various geopolitical disruptions and domestic bottlenecks. When geopolitical tensions escalate, shipping lanes may be blocked or rerouted, as seen in the Red Sea where attacks on commercial vessels forced carriers to avoid the Suez Canal and take longer routes via the Cape of Good Hope. Similarly, sanctions and trade restrictions like those imposed during the Russia-Ukraine war disrupt the flow of raw materials such as aluminium, steel, and semiconductors, which are critical to auto manufacturing. Tariffs also contribute to freight cost volatility by altering sourcing patterns.

Beyond geopolitics, domestic infrastructure bottlenecks such as port congestion, limited multimodal and hinterland connectivity, labour shortage and inconsistent warehousing standards also contribute to freight cost volatility. Fuel price fluctuations, and container shortages further add unpredictability in logistics costs.

War risk and marine cargo insurance have also surged due to rising geopolitical tensions. Marine cargo insurance, which protects goods in transit, has seen significant hikes due risk exposure in high-conflict zones. Smaller insurers are withdrawing from the market, leaving only niche players and high-risk underwriters to offer coverage[30].

Working capital, inventory management, and pricing strategies

Efficient logistics ensures timely delivery, which helps maintain optimal inventory levels. Having resilient supply chains ensures that the OEMs have the required components and materials for production. Resilient supply chains are particularly critical for OEMs, as they rely on a steady flow of parts to sustain uninterrupted production. Any disruption in logistics, whether due to geopolitical events, infrastructure bottlenecks, or supplier delays can lead to production halts, increased costs, and margin compression.

These delays due to increase in shipping time have forced companies to hold higher inventory levels to buffer against uncertainty, thereby increasing the cash tied up in working capital

Sound logistics also support Just-In-Time (JIT) manufacturing, a strategy that minimises inventory holding costs and enhances working capital efficiency. Local sourcing is one of the major strategies used by OEMs to reduce dependence and ensure resilience. For example, a leading OEM promoted local sourcing, with 77% of direct materials procured from suppliers located near manufacturing units[31].

[30] Media sources
[31] BSE

Pricing strategies are under pressure from rising input and logistics costs. OEMs are increasingly adopting modular platforms and shared components to reduce complexity and maintain affordability[32].

Case examples from Indian OEMs and suppliers

An auto component player has initiated digital transformation to enhance factory intelligence and supply chain agility. In partnership with Microsoft, the company deployed AI-powered agents using Microsoft Fabric and Azure to unify data across ERP (Enterprise Resource Planning) systems[33]. These tools allow plant managers to analyse scrap rates and energy usage in real time, enabling faster decision-making. This has led to improved inventory turnover, reduced working capital requirements, and enhanced responsiveness to market demand.

A major OEM has made significant strides in logistics efficiency and emissions reduction. The company has aggressively expanded its use of rail transport, dispatching over 5.18 lakh vehicles via rail in FY2024–25, which helped avoid nearly 10,000 metric tonnes of CO_2 emissions[34]. The company now aims to increase its rail dispatch share to 35% by FY2031, reinforcing its commitment to sustainable logistics[35].

Given the magnitude and persistence of these challenges, companies are increasingly looking beyond traditional cost-control methods and turning to advanced technological solutions. Digitalisation, automation, and data-driven logistics systems are emerging as critical tools to minimise the impact of market fluctuations, optimise routes, reduce idle time, and enhance visibility across the supply chain. Thus, while freight volatility underscores the vulnerabilities in the automotive logistics ecosystem, technology offers a pathway to resilience and efficiency — making it an essential enabler of stability in an otherwise uncertain operating environment.

Technology as a strategic enabler

The Indian logistics industry stands on the brink of a digital revolution, driven by rapid technological advancements that aims to redefine supply chain performance, resilience, and competitiveness. Historically, the Indian logistics sector has been fragmented with high costs, accounting for 13–14% of the GDP compared to the global 6–8%, the sector is now turning to technology as a key lever for transformation.

The technological revolution is manifesting through deployment of cutting-edge technologies such as the Internet of Things (IoT), blockchain, and digital twins, all of which are driving process optimisation across supply chains. Complementing these techniques, predictive analytics capabilities, real-time visibility platforms, and logistics control towers are empowering organisations to maintain seamless operation.

The technology adoption landscape in India

India's logistics technology adoption is experiencing rapid acceleration, driven by various market dynamics and substantial government support. Government initiatives have established a framework for technological transformation in the logistics sector. The national logistics policy emphasises technology adoption and digitalisation to reduce logistics costs from 13-14% of GDP to single digits, this policy also aims to reduce logistics costs, improve India's Logistics Performance Index (LPI) ranking to be among the top 25 countries by 2030.

Complementary initiatives like PM Gati Shakti National Master Plan are providing multimodal connectivity infrastructure, and the Unified Logistics Interface Platform (ULIP) is working to integrate digital services across the transportation sector.

[32] CII
[33] Schaeffler unlocks factory insights with Microsoft Cloud for Manufacturing | Microsoft Customer Stories
[34] Maruti Suzuki Press release
[35] The Economic Times

The convergence of policy support, technological innovation, and infrastructure development positions India's logistics sector for substantial transformation. The following section will examine in detail how IoT, blockchain, and digital twins are specifically reshaping logistics operations.

Internet of Things

IoT has emerged as the backbone of modern logistics, enabling visibility and control across supply chains. Logistics companies are deploying IoT across multiple dimensions such as warehouse management, inventory management and order management. The technology enables sophisticated predictive analytics and automated decision-making. The global IoT in supply chain management market was valued at USD 35.5 billion in 2024 and is forecasted to reach USD 85.7 billion by 2033, growing at a 10.4% CAGR[36]. Implementation spans multiple operational areas, with asset tracking representing the largest application segment, followed by inventory management and predictive maintenance[37].

IoT's impact extends beyond basic tracking capabilities, enabling complex predictive analytics and automated decision-making that fundamentally transforms traditional logistics practices. Real time tracking with GPS and RFID provide continuous monitoring of location, condition, and status of the shipments within the country. This visibility is crucial in India, where over 64%[38] of goods are transported by road, this visibility can help in reducing inefficiencies and minimising errors.

IoT implementation can deliver substantial operational improvements across key performance metrics. With research indicating that logistics cost can be reduced up to 15% through proper implementation[39]. The technology enables enhanced supply chain efficiency through automated inventory management, optimised route planning, and improved demand forecasting.

Blockchain

For centuries, businesses have been built on the principle of trust, however, this business of trust is about to be disrupted due to the rise of blockchain technology.

Blockchain is a distributed ledger technology that maintains a continuously growing list of records, called blocks, which are linked and secure using cryptographic principles. This technology creates distributed ledgers that record every transaction and movement across the supply chain, eliminating the need for intermediaries while ensuring everyone has access to the same information. The blockchain in supply chain market in India has achieved significant growth, reaching USD 38.29 million in 2024 and projected to grow to USD 781.10 million by 2033, showing a 39.80% CAGR[40]. This shift highlights the growing importance of blockchain in managing global supply chains.

Today a significant value is trapped in logistics, largely due to the fragmented nature of the industry. For example, in India alone around 12.5 million trucks on the road, operated by approximately 3.5 million truck operators[41]. With such a huge number of stakeholders involved, it creates low transparency, unstandardised processes, and diverse levels of technology adoption.

Blockchain technology can improve operational efficiency through faster transaction processing, reduced paperwork requirements, and enhanced real-time tracking capabilities. In the logistics industry, paying and invoices may be a time-consuming process. To solve this, smart contracts are a solution offered by blockchain technology. By automating tedious

[36] Media sources
[37] Media sources
[38] Media sources
[39] Media sources
[40] Media sources
[41] Media sources

processes through smart contracts, blockchain reduces administrative overhead, paperwork, and manual errors. This automation speeds up customer clearance, gate checks and payments, ultimately leading to time saving.

There have been instances of freight invoices reporting inaccurate data which leads to disputes as well as many other process inefficiencies in the logistics industry. Blockchain provides a ledger which is accessible to all the stakeholders, this means companies can track goods from origin to endpoint with complete accuracy, mitigating the risks of discrepancies and fraud. For sectors like automotive, this visibility is crucial for quality assurance.

While blockchains offer clear benefits, it is not without its challenges. Blockchain comes with high initial costs, demands for skilled personnel, integration hurdles with existing systems, and significant energy consumption. Despite these obstacles, as the logistics industry continues to evolve, blockchain stands out as a promising solution to address fragmentation and inefficiency.

Digital twins

Digital twin technology is a virtual replica of a physical object, system, or process that is constantly updated using real-time data from sensors and other sources. This technology combines IoT, AI, and data analytics to enable organisations to visualise, monitor, and analyse physical assets in a digital environment without disrupting actual operations.

In logistics, digital twins create virtual models of warehouses, fleets, or entire supply chains. By replicating real world operations using live data, digital twins enable logistics teams to visualise, optimise and quickly respond to challenges. Other than this, digital twins can help in exploring what-if scenarios to help the companies prepare for a variety of circumstances.

While digital twins offer significant benefits, it suffers from the same setbacks as blockchain technology, that being high initial setup costs, the need for skilled personnel, and integration complexities with existing systems.

Predictive analytics for risk management

In a world where supply chains are volatile and interconnected, traditional risk management approaches are no longer sufficient to ensure resilience and efficiency. Logistics operations face a growing array of disruptions, from weather to geopolitical ones.

These disruptions can lead to delayed deliveries, increased costs, and customer dissatisfaction. Executives see these headlines regularly, yet they can't predict what the next disruption will be. Predictive analytics addresses this challenge by enabling logistics firms to anticipate risks before they materialise.

Predcitive analytics is rapidly becoming a cornerstone of risk management, enabling forms to anticipate disruptions and take proactive steps. By integrating real-time data from various sources, it enables organizations to anticipate disruptions, optimise operations, and enhance decision-making. This proactive approach boosts agility and supply chain resilience, enabling leaders to respond to challenges and capitalise on opportunities. This shift from reactive to proactive planning allows logistics providers to reroute shipments, adjust inventory levels, and optimise resource allocation before issues escalate.

AI driven predictions have a clear advantage over traditional spreadsheet based analytical methods. AI-driven forecasting can reduce supply chain errors and decrease lost sales due to product unavailability. Real-world applications underscore its impact, e.g., an industry leader used predictive analytics to reroute inventory during store closures in China.

As logistics continues to evolve in complexity and scale, predictive analytics is proving to be a vital asset for building resilient, responsive supply chains. Its ability to transform real time data into actionable insights.

Global automotive hubs: Strategic responses to crises

Germany, Japan, and South Korea: One of the world's most advanced automotive manufacturing nations have faced repeated disruptions over the past decade, including the COVID-19 pandemic, the EverGiven blockage, and the semiconductor shortage. Their responses reveal a sense of strategic resilience.

In Germany, automakers adopted scenario planning, cross-functional coordination, and risk modelling to anticipate future disruptions. Resilience has become a strategic imperative, with firms embedding risk management into long-term planning to handle geopolitical tensions, supply chain bottlenecks, and technological shifts like electrification and autonomous driving.

Japan's automakers relied on its *Keiretsu* supplier network and decentralised production model. This allowed it to maintain continuity during the semiconductor crisis by leveraging dual sourcing and buffer inventory.

South Korean firms responded by localising production in key markets such as India and the US., reducing exposure to global shipping bottlenecks.

Lessons from COVID-19, EverGiven blockage, and semiconductor shortages

The COVID-19 pandemic exposed the problems in just-in-time (JIT) model. In early 2020, automakers cancelled semiconductor orders as demand collapsed. But by late 2020, demand rebounded, especially for EVs, leaving OEMs scrambling for chips. The German Aerospace Center found that the crisis was driven by overlapping short-term disruptions and long-term structural issues in chip manufacturing[42].

The EverGiven blockage in the Suez Canal in 2021 further highlighted the vulnerability of global logistics. Automakers were compelled to reroute shipments, increased air freight usage, and accelerated digital logistics platforms. It is estimated that over 9.5 million vehicles were lost in 2021 due to chip shortages, with another 3 million affected in 2022[43]. Even as the crisis eased in 2023, demand for automotive-grade chips continues to outpace supply. The average semiconductor value per vehicle is expected to rise from USD 500 in 2020 to USD 1,400 by 2028.

Global OEMs are moving away from strict JIT models. German and Japanese automakers now maintain buffer inventories of semiconductors, wiring harnesses, and rare earth materials. South Korean firms diversified their supplier base across Southeast Asia and India to reduce dependency on China and the US companies are turning towards the China +1 policy and wanting to expand their manufacturing industries rather than remaining completely reliant on China.

Strategic sourcing and digital procurement will separate leaders from laggards in India's automotive industry. Localisation of manufacturing is a big trend and capital expenditure for new projects pertaining to updating vehicles has risen since 2022. Indian OEMs are embracing GenAI, digital twins, and smart warehousing to build more agile supply chains. Technologies like IoT, blockchain, and advanced analytics are being deployed to create transparent, responsive ecosystems. The rise of this new technological powered industry is transforming factories into smart, interconnected hubs that can manoeuvre through disruptions and optimise operations in real time.

[42] Media sources
[43] Media sources

Policy, trade, and infrastructure recommendations

The Indian government and industry bodies such as the Automotive Component Manufacturers Association (ACMA) play a pivotal role in building resilience across the automotive logistics ecosystem. The government must act as a strategic enabler by formulating responsive policies, investing in infrastructure, and facilitating global partnerships. ACMA, on the other hand, should lead industry-wide initiatives such as supplier capability building, sustainability benchmarking, and digital transformation programs.

Government-led initiatives like PM *Gati Shakti,* Bharatmala, and Sagarmala have laid the groundwork for multimodal connectivity and port modernisation. These must be scaled up with targeted investments in hinterland connectivity, smart warehousing, and logistics parks. ACMA can complement these efforts by promoting supplier diversification, supporting MSMEs in adopting digital tools, and facilitating collaboration between OEMs and Tier suppliers to reduce Scope 3 emissions and improve supply chain transparency.

- **Trade agreements, FTAs, and regional partnerships:** India's automotive export footprint is heavily concentrated in Europe, North America, and Asia, making it vulnerable to geopolitical tensions such as the Red Sea crisis, the EU sanctions on Russian oil, and China–Taiwan semiconductor risks. To mitigate these exposures, India must diversify its trade relationships through strategic Free Trade Agreements (FTAs) and regional partnerships.

  The government should prioritise FTAs with emerging markets in Africa, Latin America, and Southeast Asia that are increasingly important for two-wheeler and commercial vehicle exports. These agreements should include provisions for tariff reductions, logistics cooperation, and technology transfer. Additionally, India should actively participate in regional supply chain alliances and forums to position itself as a reliable alternative to China in the global automotive value chain.

- **Emerging Freight Routes and Strategic Corridors in India:** India's freight landscape is undergoing a strategic transformation, driven by geopolitical shifts, trade diversification, and infrastructure modernization. Key among these is the India–Africa corridor, with growing maritime links to ports in Kenya, South Africa, and Senegal, supporting bilateral trade in automobiles, pharmaceuticals, and raw materials. The launch of the India–Middle East–Europe Economic Corridor (IMEC) at the G20 Summit marks a pivotal development, offering an alternative to traditional Suez Canal routes and enhancing connectivity via UAE, Saudi Arabia, and Israel to Europe. Additionally, the Indo-Pacific Maritime Corridor and the Asia–Africa Growth Corridor (AAGC), backed by India and Japan, are fostering sustainable logistics and digital infrastructure across Southeast Asia and East Africa. The International North-South Transport Corridor (INSTC), connecting India to Central Asia and Europe via Iran and Russia, is also gaining traction. These emerging routes not only reduce transit times and costs but also mitigate risks from congested or conflict-prone zones, positioning India as a resilient and diversified freight hub in the global supply chain.

- **Port modernisation, multimodal logistics, and green corridors:** India's port infrastructure, while expansive, suffers from underutilisation, congestion, and inconsistent performance. Major ports like JNPT and Mundra operate efficiently, but others face bottlenecks due to poor hinterland connectivity and outdated cargo handling systems. To address this, the government must accelerate port modernisation through PPPs, focusing on digitisation, automation, and capacity expansion.

  Multimodal logistics must be promoted to reduce overreliance on road transport, which currently accounts for over 60% of freight movement. Rail, inland waterways, and coastal shipping offer cost-effective and sustainable alternatives. Investments in multimodal logistics parks, dedicated freight corridors, and integrated transport hubs will be essential to optimisecargo flow and reduce logistics costs.

  Green corridors should be developed to support low-emission logistics, especially for EV supply chains. These corridors can be powered by renewable energy and supported by electric fleets, smart warehousing, and AI-driven control towers. Such initiatives will not only reduce carbon footprints but also enhance India's competitiveness in global markets that increasingly value sustainability.

Recommended policy roadmap outline

Short-term (0–2 Years): Tactical Stabilisation and digital readiness

- In the immediate term, India must focus on tactical interventions that stabilise logistics operations and enhance digital readiness. Establishing a national logistics emergency response framework is critical to managing disruptions like the Red Sea crisis or semiconductor shortages. This framework should include contingency routing protocols, emergency insurance support, and coordination mechanisms between OEMs, suppliers, and government agencies.
- Digital freight corridors should be accelerated through platforms like the ULIP, enabling real-time tracking, documentation, and customs clearance. These corridors will reduce delays and improve transparency across multimodal networks. Additionally, the government should consider offering temporary insurance subsidies or risk-sharing mechanisms to exporters affected by war-risk premiums and rerouting costs, especially in vulnerable sectors like two-wheeler exports and EV components.

Medium-term (2–5 Years): Infrastructure modernisation and trade diversification

- Over the medium term, India must invest in infrastructure modernisation and trade diversification to reduce systemic vulnerabilities. Port modernisation should be prioritised, focusing on berthing capacity, cargo handling equipment, and turnaround time improvements. Public-private partnerships (PPPs) can play a pivotal role in upgrading major ports like JNPT, Chennai, and Mundra, while also enhancing connectivity to hinterland regions through dedicated freight corridors and multimodal logistics parks.
- Simultaneously, India should reassess and renegotiate FTAs to diversify export markets and reduce overdependence on any single region. Strategic partnerships with Southeast Asia, Africa, and Latin America can open new avenues for automotive exports, particularly for two-wheelers and commercial vehicles. Regulatory reforms should also streamline customs procedures and reduce compliance burdens for logistics providers and exporters.

Long-term (5–10 years): Strategic resilience and global positioning

- In the long run, India must build strategic resilience and position itself as a global automotive logistics hub. Developing green logistics corridors powered by electric vehicles, rail, and inland waterways will reduce carbon emissions and logistics costs. These corridors should be integrated with smart warehousing and digital control towers to enable predictive analytics and real-time decision-making.
- India must also invest in domestic capabilities for rare earth processing and semiconductor manufacturing. Establishing strategic reserves and incentivising local production will reduce dependency on China and Taiwan, especially for EV and electronics components. Furthermore, India should actively pursue global supply chain alliances, positioning itself as a China+1 destination for automotive manufacturing. This will require coordinated efforts across ministries, industry bodies like ACMA and SIAM, and international stakeholders.
- By implementing this phased roadmap, India can transform its automotive logistics ecosystem into a resilient, efficient, and globally competitive network- capable of withstanding future disruptions and driving sustainable growth.

Conclusion

India's automotive industry is entering a transformative phase marked by rapid growth, increasing global competitiveness, and rising geopolitical complexity. As the sector expands its footprint across global markets, it faces mounting challenges from supply chain disruptions, freight cost volatility, and infrastructure bottlenecks. Geopolitical tensions such as the tariff uncertainty, Red Sea crisis, Russia-Ukraine disturbances, and China-Taiwan semiconductor risks have exposed critical vulnerabilities in India's logistics ecosystem, underscoring the urgent need for resilience and strategic foresight.

India's automotive supply chain continues to face dual pressures- heavy reliance on imports from China, Europe, and Japan, and concentrated exports to geopolitically sensitive regions. This exposure has been magnified by recent global disruptions, prompting the need for a strategic recalibration of trade relationships, supplier networks, and logistics infrastructure.

Technology emerges as a powerful enabler in this landscape. The adoption of AI, IoT, blockchain, and digital twins is reshaping logistics operations, offering predictive risk management, real-time visibility, and operational agility. These innovations, coupled with smart warehousing and control towers, are essential to navigating future disruptions and optimising supply chain performance.

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Trends in Credit Profile of Auto Component Inc.

By

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Trends in Credit Profile of Auto Component Inc.
AUGUST 2025


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Agenda
Trends in revenue growth and outlook
Demand drivers
Profitability – trends and drivers
Capex plans to leverage opportunities
Leverage and coverage in the sector



Trends in revenue growth and outlook

Vehicle premiumisation and localization to yield high single-digit revenue growth in FY2026

Indian auto components | Clocks 9.2% revenue CAGR over the past six years

ICRA

Exhibit: Indian auto component industry revenue trend

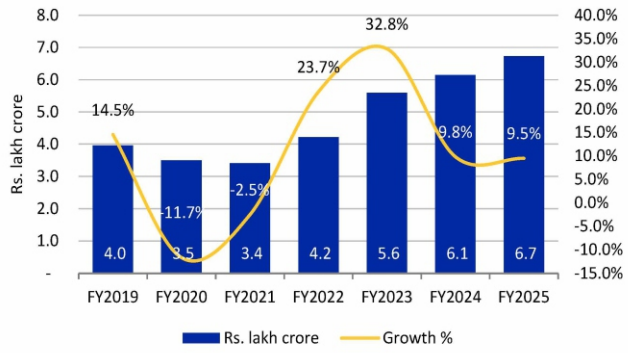
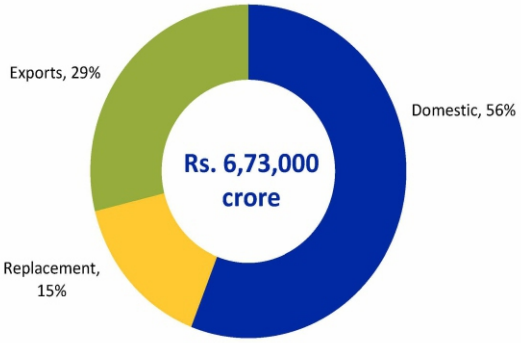


Exhibit: Demand Sources for the Indian Auto Component industry (FY2025)



- The Indian auto component industry revenues grew at a CAGR of 9.2% over FY2019-FY2025.
- Overall increase in vehicle production and vehicle base in India, localisation initiatives, premiumisation of components, diversification strategy by global original equipment manufacturers (OEMs) continue to drive demand for auto component companies.

Source: ICRA Research, ACMA

Indian auto components | High single digit growth forecasted for FY2026

ICRA

Exhibit: ICRA's Outlook for the Indian Auto Component Industry for FY2026



ICRA's Outlook for FY2026P

Domestic OE	Domestic Aftermarket	Exports
8-10%	7-9%	5-7%

- ICRA expects the auto component industry's revenues to grow at 6-8% in FY2026.
- Apart from underlying growth in vehicle volumes, the increasing premiumisation and higher localisation, resulting in higher content per vehicle, are likely to translate into growth for component suppliers, notwithstanding any revenue impact from the recent US import tariff amendments.

Source: ICRA Research



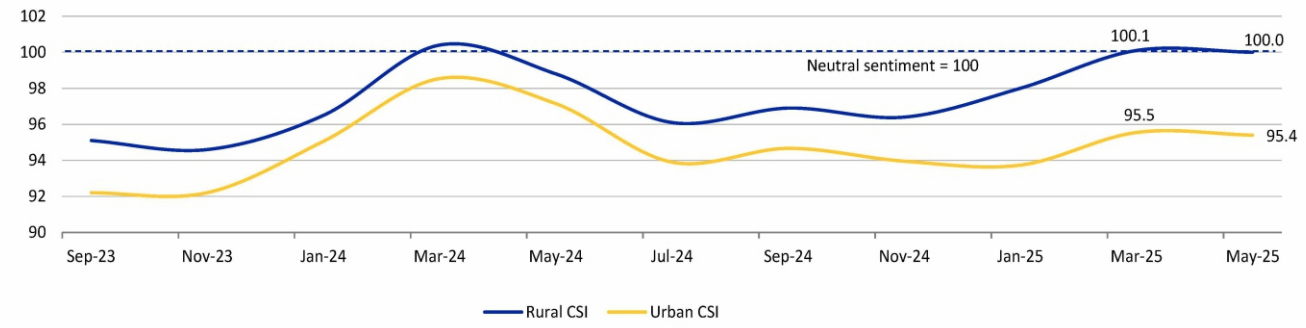
Key drivers of growth in Indian auto component industry

Structural positives to support demand for Indian auto components

Consumer sentiments largely stable in recent months, rural fares better than urban

ICRA

Exhibit : Trend in current sentiment index (CSI) of rural and urban areas



Source: RBI survey conducted in 19 major cities; ICRA Research

- The RBI's rural consumer confidence survey (RCCS), revealed that the current situation index (CSI) for the rural and semi-urban households has hovered around the neutral territory in both May 2025 and March 2025 rounds, after being pessimistic through most part of FY2025.
- The May 2025 round of the RBI's urban CCS (UCCS) revealed that urban consumer sentiments remained largely unchanged, and continued to trend in the negative territory, below the rural CSI levels.

Private consumption I Structural factors to support consumption and demand

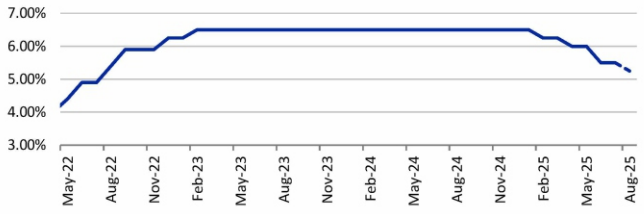
ICRA

Exhibit: Sizeable income tax relief in FY2026 to raise discretionary income of households and spur demand for auto, services, etc.

Tax slabs (%)	Previous (Rs.)	Revised (Rs.)
Nil	0 to 3 lakh	0 to 4 lakh
5%	3-7 lakh	4-8 lakh
10%	7-10 lakh	8-12 lakh
15%	10-12 lakh	12-16 lakh
20%	12-15 lakh	16-20 lakh
25%	-	20-24 lakh
30%	Above 15 lakh	Above 24 lakh

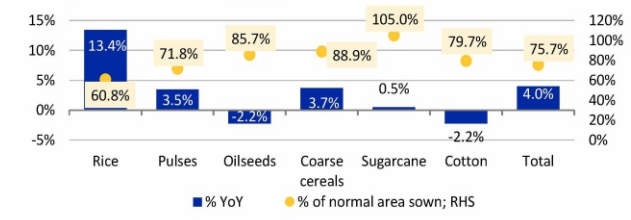
Source: Union Budget; ICRA Research

Exhibit: The MPC is expected to deliver a 25-bps rate cut in August 2025 meeting; personal loan offtake for consumption remains a monitorable



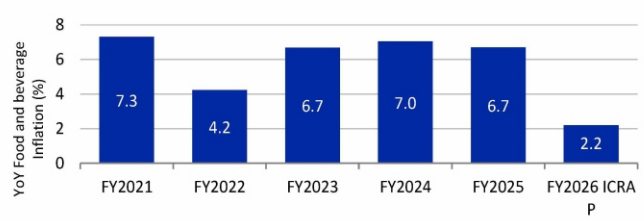
ICRA's projections for August 2025 has been used; Source: RBI; ICRA Research

Exhibit: Kharif sowing completed on 76% of the normal sown area and up by a healthy 4.0% YoY as on July 25, 2025



**Normal area is computed as five-year average of total kharif sowings; Source: Ministry of Agriculture and Farmers' Welfare; ICRA Research*

Exhibit: Food inflation is likely to dip in FY2026

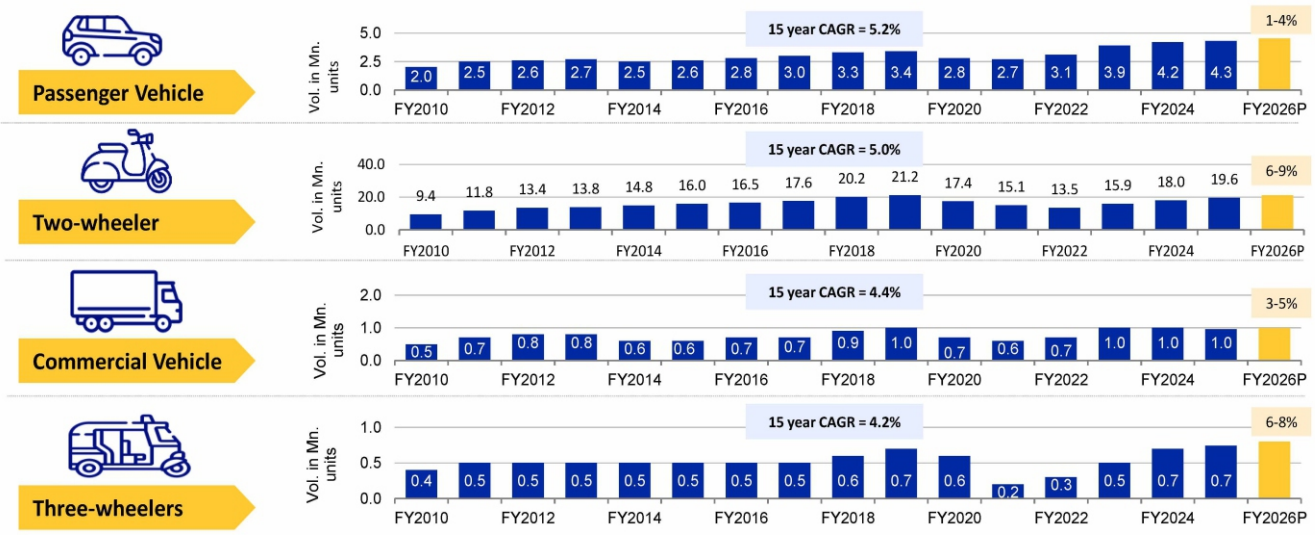


P: Projected; Source: NSO; CEIC; ICRA Research

Domestic OE | Most segments to grow at mid-single digits in FY2026

ICRA

Exhibit: Long-term Trend in Automobile Sales Volumes (Domestic)



Source: SIAM Data, ICRA Research

Domestic OE | Structural factors remain intact

ICRA

Exhibit: Demand Drivers and Challenges for Automotive Sub-segments

Consumer segments	Commercial segments	Auto components
Disposable income	Economic outlook	Premiumisation
New model launches	Infrastructure	EV opportunities
Supply chain	Freight	Localisation
Inventory levels	Regulations	Regulatory changes
Cost of ownership	Cost of ownership	Export market
Financing environment	Financing environment	Aftermarket

The impending revision in GST rates, with expectations of a rate cut for new cars, can provide a further impetus to new vehicle sales, while dampening the momentum of used car sales growth.

Source: ICRA Research

Domestic Aftermarket | Multiple favourable factors at play

ICRA

Exhibit: Aftermarket Revenue Drivers

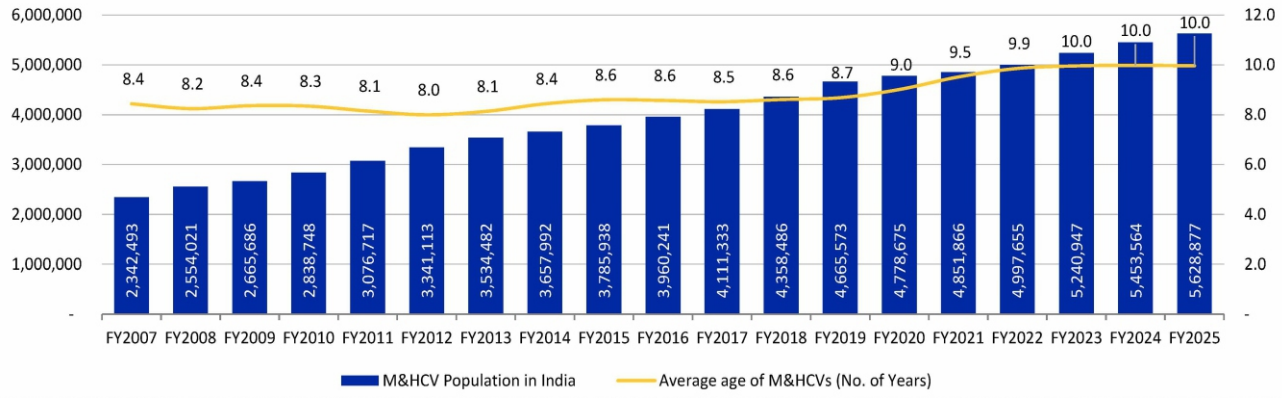
Increased mobility and higher freight movement	Vehicle parc increase; higher average age of vehicle population and used vehicle purchases	Reduced imports, lower offtake from unorganised segment and growth in share of branded parts	Deeper penetration in rural/semi-urban regions	Better awareness among consumers about vehicle safety and importance of periodic maintenance

Source: ICRA Research

Domestic Aftermarket | Ageing CV fleet augurs well for replacement demand

ICRA

Exhibit: Trend in M&HCV population and average age



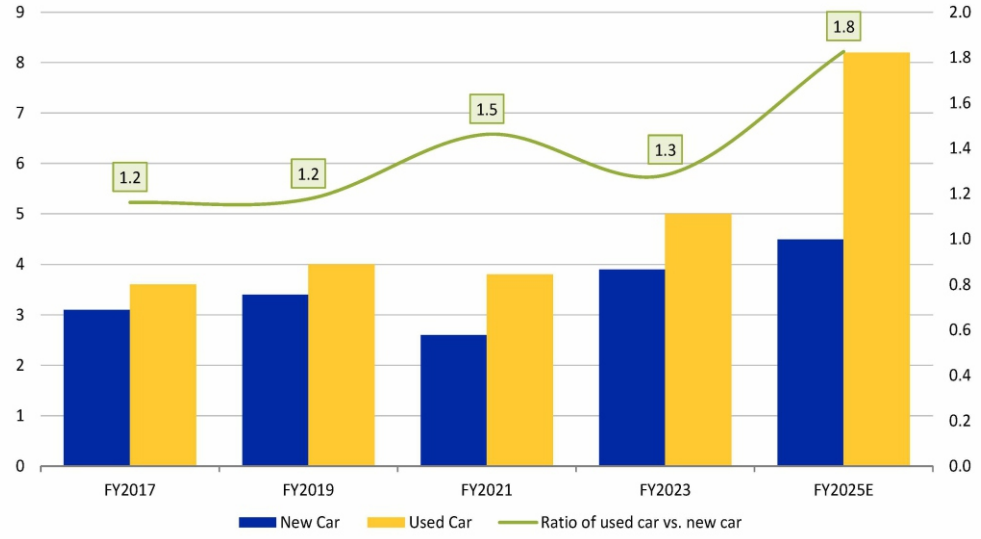
As per ICRA's estimates, the average age of M&HCVs increased to approximately 10 years since FY2023, the highest in the past two decades, which augurs well for replacement demand for auto components. More than 20% of M&HCV parc were older than 15 years as of March 2025.

Source: CMIE, ICRA Research;

Domestic Aftermarket | Increased used car sales supports replacement demand

ICRA

Exhibit: Trend in new car vs. used car sales in India (units in million)



Growth of organised players, offering enhanced accessibility and reliable services/products aiding used car sales

Used car demand boosted by increasing prices of new cars; financing penetration also supportive

Source: Indian pre-owned car market study, Frost & Sullivan, ICRA Research

Premiumisation | Vehicle premiumisation trends gain pace in passenger cars

ICRA

Exhibit: Segment-wise growth trend (annual)

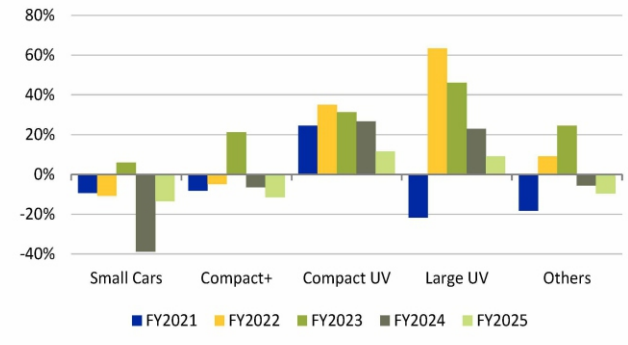
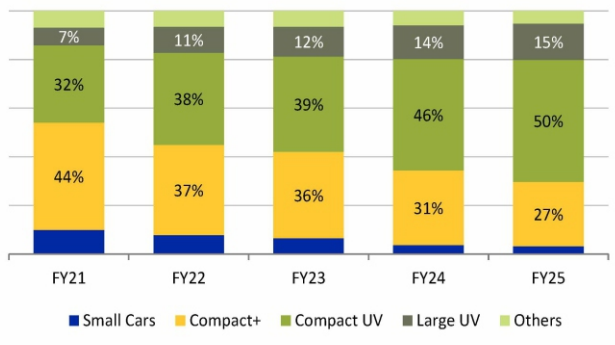


Exhibit: Segment-wise mix



Source: CMIE Data, ICRA Research; Compact UV - Length 4000-4400 mm; Large UV – Length > 4400 mm

- The UV segment registered strong growth over the past three fiscals. Consequently, its share in total car production reached 65% in FY2025 from 39% in FY2021.
- The growing popularity of SUVs in India mirrors a global trend where they have become the preferred vehicle of choice. Factors driving this shift in consumer preferences include higher ground clearance and wheelbase that enhance driving quality, a higher seating position that improves visibility of the road, ample storage space and others. With the SUV segment gaining popularity over years, the OEMs have also lined up most of their launches in this segment, in line with consumer preferences.
- Overall, the increasing preference for higher-end, feature-rich cars augurs well for auto component suppliers as well, with increased content per vehicle in these cars vis-à-vis entry-level small and compact cars.

Premiumisation I Premiumisation trend gathering pace in 2Ws as well

ICRA

EXHIBIT: Trend in recovery of entry-level, commuter, premium motorcycles and scooter segments (% of FY2019 volumes)

	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
75-110 CC - Entry Level	76%	64%	59%	62%	67%	67%
110-150 CC - Commuter	99%	89%	77%	98%	112%	130%
>150 CC - Premium	84%	91%	78%	98%	123%	123%
Scooters	83%	67%	60%	73%	80%	91%

Recovery in two-wheeler segment over past couple of years has been driven by higher-end motorcycles, which have premium features and specifications. This augurs well for demand for auto components as well in terms of increased content per vehicle.

Source: ICRA Research

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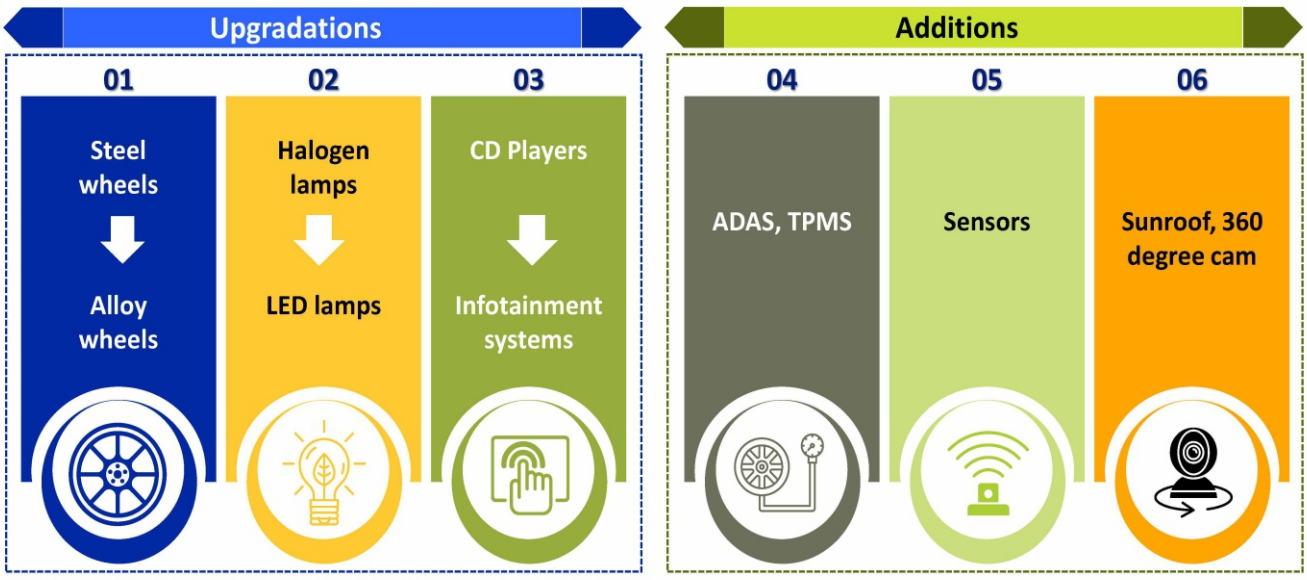
Premiumisation I Demand for premium, high-end features support increase in CPV

ICRA

Exhibit: Premiumisation examples within auto components



Source: ICRA Research

CPV: Content Per Vehicle; LED: Light Emitting Diodes; CD: Compact Disc; ADAS: Advanced Driver Assistance Systems; TPMS: Tyre Pressure Monitoring Systems

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Exports I Demand uncertainties with rising trade protectionism and slowdown in growth in the developed markets

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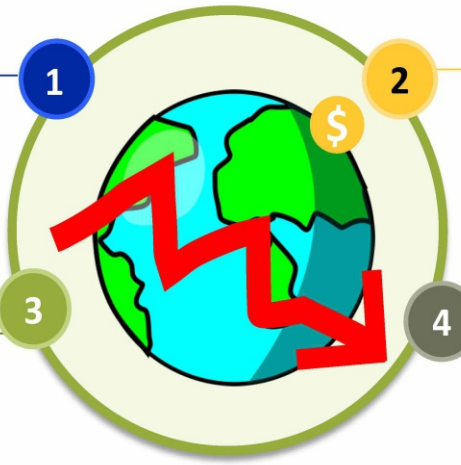
Geopolitical tensions

Geopolitical tensions spanning the Russia-Ukraine war, Israel-Palestine conflict, US-China rivalry and India-Pakistan border developments are influencing regional dynamics and remain key concerns for the global economy.

Uncertain interest rate environment

The trend in bond yields remain divergent across major economies with some witnessing increasing yields while others witnessing moderation. In India, with a cumulative rate cut of 100 bps since February 2025 and softening of bond yields, along with the availability of sizeable systemic liquidity, the funding cost for borrowers is set to moderate in FY2026.



Strain in global trade relations

Global trade patterns are directly driven by trade policies of member nations. These have strained lately due to rising protectionism, which could impact India's exports in the near to medium term.

Fear of slowdown in global growth

The tepidness in India's merchandise exports is likely to continue in FY2026, with tariff-related developments posing downside risks to the outlook, even as lower crude oil prices will be supportive. Services exports too are likely to slow down as corporates in advanced economies show circumspection towards spending in an uncertain macro and trade environment.

Auto components is one of the key sectors witnessing the impact of tariff-related uncertainties

Exports I Global macro-economic uncertainties a key headwind for exporters

ICRA

Exhibit: Demand Sources for the Indian Auto Component Industry (FY2024)

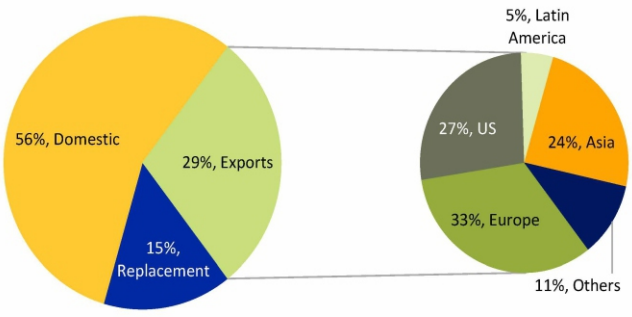
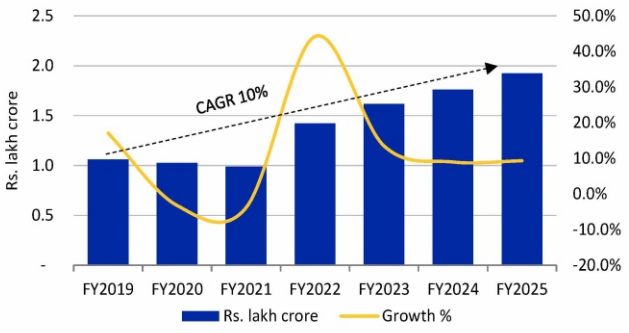
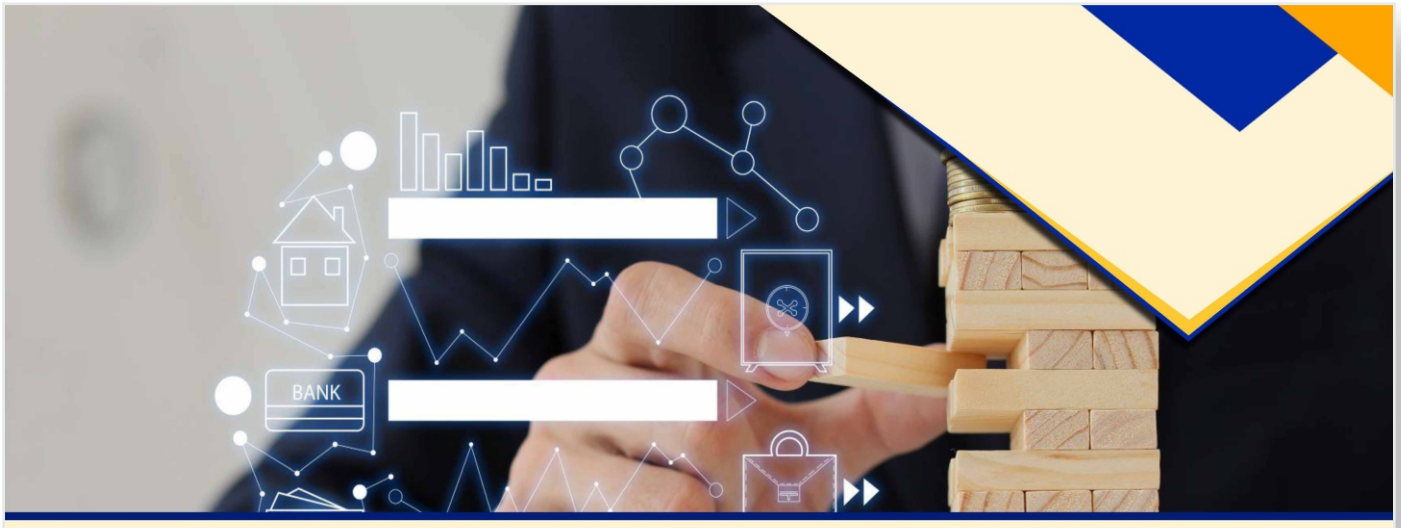


Exhibit: Exports of auto component from India, by Value



Source: ACMA, ICRA Research; excludes batteries and tyres

The Indian auto component industry derived close to 30% of revenues from exports to different geographies, with key markets being Europe, USA and other Asian countries. While there has been a general softness in the key markets of Europe and North America due to macro-economic uncertainties, the focus on vendor diversification by most OEMs, including China+1 strategy, has been supportive for Indian auto-ancillaries. Nevertheless, with 8% of the Indian auto-component revenues derived from USA, which would be subject to the tariff-related developments, short-term uncertainties abound.



Operating profitability in Indian auto component industry

Divergent trends in commodity prices and tariff-related developments to limit margin improvement prospects

Margins vulnerable to commodity movements and geo-political developments

ICRA

Exhibit: Quarterly Gross Margin Trend for ICRA's Sample Set

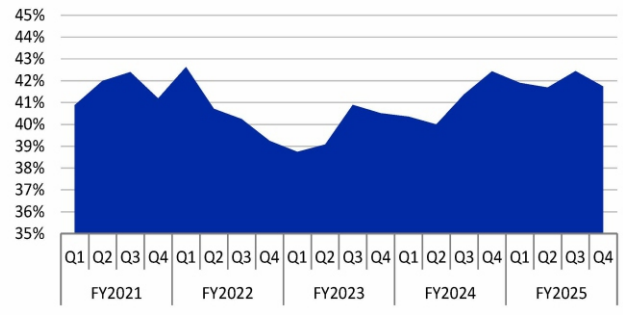
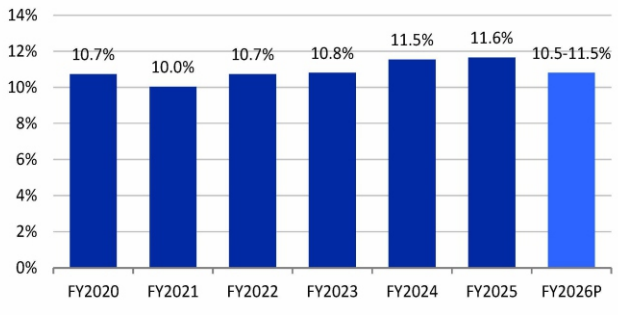


Exhibit: Operating Margin Forecast for ICRA's Sample Set



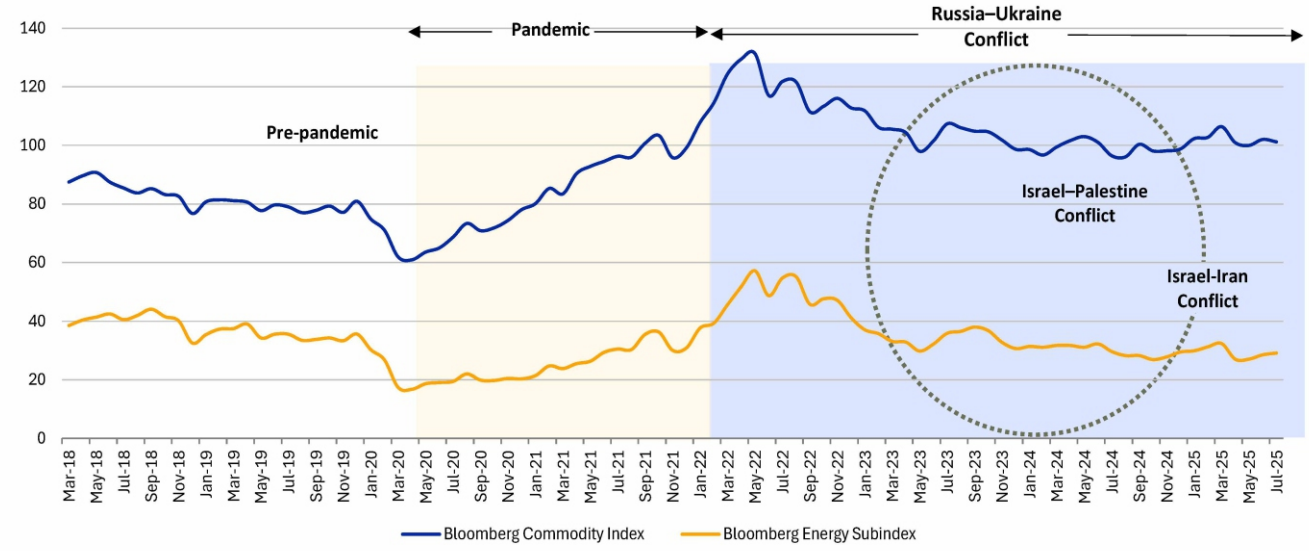
Source: : ICRA Research, Ace Equity; Based on 46 large auto ancillaries with aggregate annual revenues of over Rs. 3,30,000 crore in FY2025

Gross margins of auto-ancillaries continue to remain a function of commodity price movements and value addition by component suppliers. Any significant variations in commodity price movements, and lag in passing on the same to customers, can impact the profitability and earnings of component suppliers. Operating margins are expected to remain range-bound and hover between 10.5-11.5% in FY2026, supported by benefits from operating leverage, higher content per vehicle and value addition while remaining vulnerable to any significant unfavourable movements in commodity prices and foreign exchange rates and any impact from the recent US import tariff amendment.

Commodity index largely stable over recent months; tariff impact monitorable

ICRA

Exhibit: Trend in Bloomberg Commodity Index and Bloomberg Energy Index



Source: Bloomberg, ICRA Research

Commodity prices reporting divergent trends impacted by global uncertainties

ICRA

Exhibit: Trend in Domestic/Chinese Hot-Rolled Coil (HRC) Spot Prices (ex-works, excl. duties/ taxes)

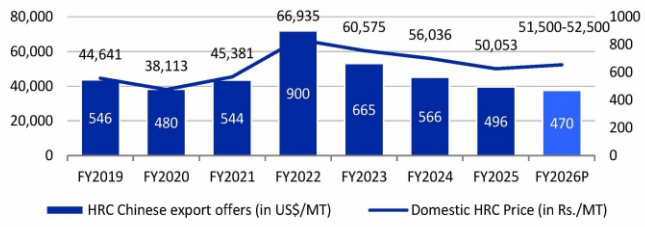
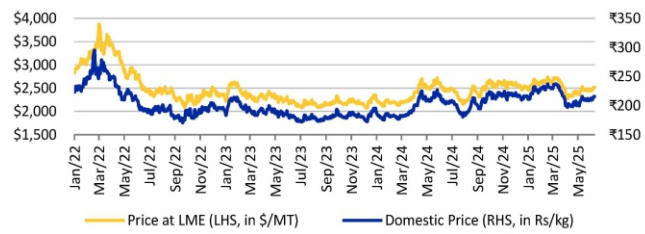


Exhibit: Trend in Domestic Copper Prices (Rs./kg)



Exhibit: Trend in domestic aluminium prices (Rs./kg) and aluminium realisation in LME (Spot in $/MT)



- The domestic HRC prices are expected to be 3-4% higher compared to significantly low levels seen in the previous fiscal, with pricing supported by the imposition of the Safeguard Duty. However, it may be noted that there is a sequential softening in domestic prices from May 2025 onwards.
- Domestic aluminium prices corrected in Q1 FY2026, in line with the global price trend.
- Domestic copper prices bounced back in May and June 2025, after witnessing significant correction in April 2025, in line with the global trends. Nonetheless, in Q1 FY2026 prices moderated by approximately 3.5% compared to same period in the previous fiscal.

Source: Bloomberg, Marklines, FTR Transport Intelligence, ICRA Research

Crude oil prices remain range-bound

ICRA

Exhibit: Trend in Brent Crude Price ($/bbl)



Source: Refinitiv, ICRA Research

- Over the last 12-18 months, there have been a series of global geo-political events, which resulted in volatility in crude oil prices. Starting from global inflationary pressures, weak Chinese demand, the Israel-Hamas conflict and sanctions on Russian oil. However, the supply balance maintained by OPEC+ countries kept the oil prices around the $70-80/bbl mark despite elevated US production.
- In April 2025, crude oil prices fell to $62–65/bbl due to two key events: US tariffs on trading partners and China's retaliatory tariffs on US crude, followed by OPEC+ announcing a larger-than-expected production increase of 411,000 bpd from May. By August 2025, prices stabilised in the $65–70/bbl range, reflecting a balance between seasonal demand and concerns over rising supply and trade tensions. The market remains cautious with limited price movement expected in the near term.
- Component players which use raw materials where pricing is linked to crude, such as plastic components, would continue to remain exposed to geo-political developments and their impact on crude prices.



Capex trends in Indian auto components industry

Several factors likely to drive capex for auto ancillaries over the medium term

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Exhibit: Medium Term Revenue Drivers

Regulatory and voluntary changes, especially for safety and emission control

New product additions & product development for committed platforms

Improved exports potential

Localisation and development of advanced technology and EV components

Premiumisation of vehicles



All of these, along with capacity enhancements as domestic volumes pick up, would necessitate investments by auto ancillaries over the medium term.

Source: ICRA Research

Industry expected to incur sizeable capex of Rs. 200-250 billion in FY2026

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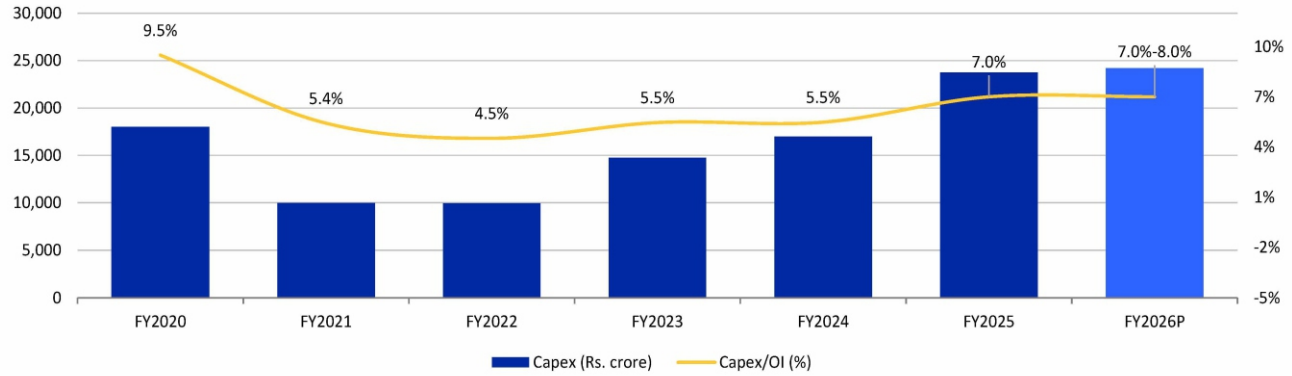
Exhibit: Capex (as % of sales) for ICRA's Sample of Large Auto Ancillaries



The auto ancillary industry is estimated to have incurred a significant capex of around Rs. 23,750 crore in FY2025, and this trend is expected to continue into FY2026. Overall, ICRA expects Indian auto ancillaries to incur capex of Rs. 20,000-25,000 crore in FY2026, hovering at 7-8% of operating income. The PLI scheme has also contributed to incremental capex towards advanced technology and EV components.

Source: ICRA Research; estimates based on sample of large auto ancillaries across various product segments

Over Rs. 25,000-crore capex expected for EV components over the next 3-4 years

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Exhibit: EV Capex Estimate for the Industry over the next 3-4 years

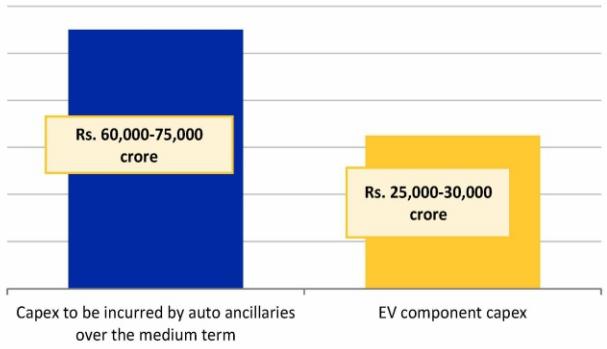
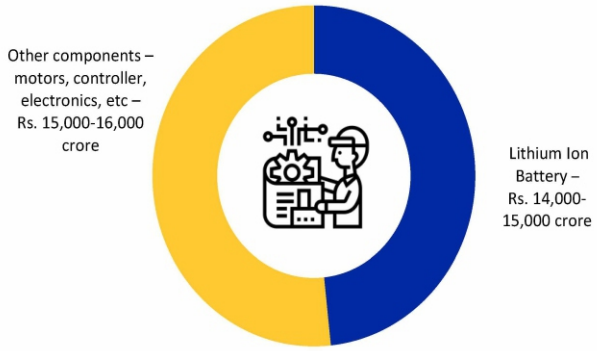


Exhibit: Break-up of EV Capex to be Incurred over the Next 3-4 years



- A sizeable part of the capex to be incurred by auto ancillaries over the medium term, will be towards EV components – for capacity building, technology and product enhancements, including light weighting and upgrading NVH parameters. Of this, about 45-50% would be for EV battery cells and packs. Auto ancillaries have entered into collaborations/JVs in cases where technology is an impediment.
- The larger projects (especially for battery cell localisation) are expected to be funded by debt initially. Capex for components other than batteries is likely to be funded largely through internal accruals. There is also substantial private equity interest in this space and a part of the funding is also anticipated from institutional capital, going forward.

Source: ICRA Research



Solvency ratios in the Indian auto components industry

Balance sheet of sector comfortable; well positioned to encash on growth opportunities

India Auto Component Inc. well capitalized for growth

ICRA

Exhibit: Trend in DSCR and Interest coverage for ICRA's Sample Set

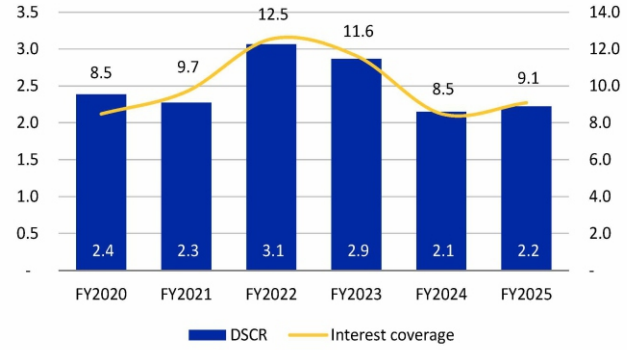
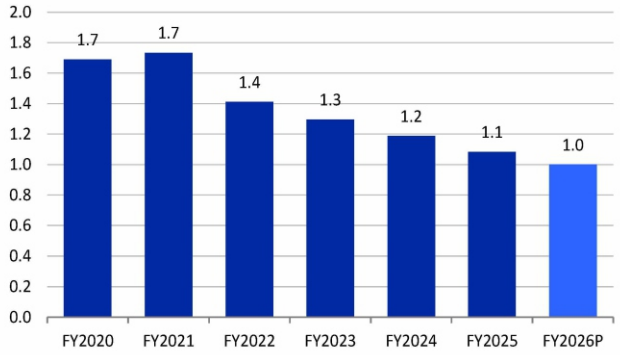


Exhibit: Trend in Total Debt/OPBITDA for ICRA's Sample Set



- Auto components is a sector where the reliance on debt has been fairly limited. Capex in the past was largely funded through internal accruals. Liquidity position remains comfortable, especially across Tier-I and II players.
- ICRA expects coverage metrics for the sector to remain comfortable going forward as well, aided by healthy accruals and relatively moderate incremental debt funding, given the expected healthy cash flows from operations.

Source: ICRA Research, Ace Equity; Based on 46 large auto ancillaries with aggregate annual revenues of over Rs. 3,30,000 crore in FY2025

Cash conversion cycle has improved over last two years supporting liquidity

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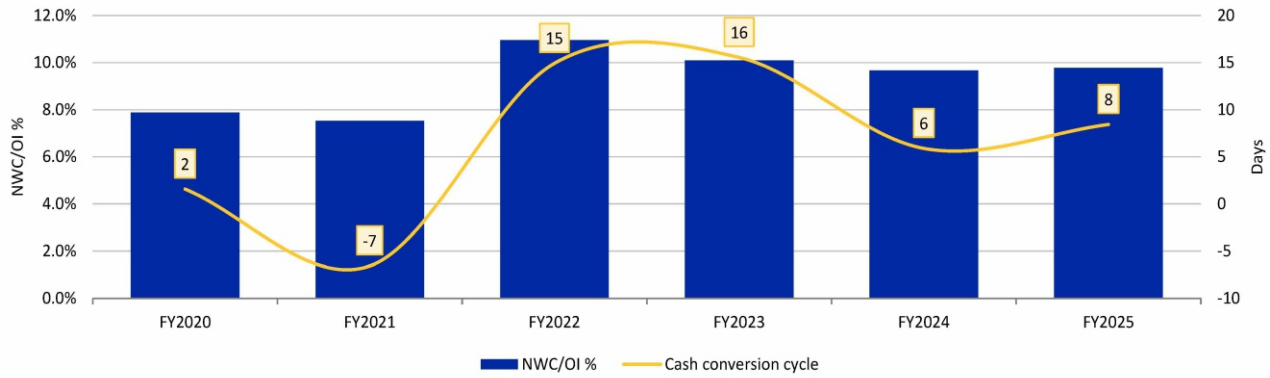
Exhibit: Trend in NWC/OI and cash conversion cycle for ICRA's Sample Set



Rationalisation of supply chain, optimal inventory holding, efficient collection from customers and favourable negotiation of terms with suppliers have supported improvement in cash conversion cycle. Faster cash conversion reduces dependency on working capital requirement and provides liquidity buffer in uncertain situations.

Source: ICRA Research, Ace Equity; Based on 46 large auto ancillaries with aggregate annual revenues of over Rs. 3,30,000 crore in FY2025

Key Takeaways

ICRA

- The Indian auto component industry is expected to grow by 6-8% during FY2026.
- While the evolving tariff situation has cast a shadow on growth in exports to the US, other demand drivers remain healthy, with supplies to domestic OEs expected to grow by 8-10%, replacement market by 7-9% and overall exports to grow by 5-7%.
- In addition to growth in vehicle parc, the premiumisation trends within the automotive sector, increasing used vehicle sales, vendor diversification by global OEs etc. augur well for growth prospects of Indian auto ancillaries.

- The profitability of Indian auto ancillaries have trended positively over the past few years, and expected to remain comfortable.
- Over the near term, operating margins are expected to remain range-bound, supported by benefits from operating leverage, higher content per vehicle and value addition while remaining vulnerable to movements in commodity prices and foreign exchange rates and evolving tariff situation.

- Indian auto ancillaries remain well-positioned to encash on the growth opportunities, with adequately capitalised balance sheets and coverage indicators which are on an improving trend.
- Indian auto ancillaries are expected to incur capex of Rs. 20,000-25,000 crore in FY2026, hovering at 7-8% of operating income, which would be funded through a prudent mix of incremental debt and internal accruals. Accordingly, the credit profile of the sector is not expected to weaken materially despite the large investment plans.

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Indian Two-wheeler Industry: Themes to Win in the Next Era of Transformation

By

KEARNEY



Photo by Sushil Kalra
Kearney, Gurugram

Indian two-wheeler industry: themes to win in the next era of transformation.

September 2025

KEARNEY

Summary



More Indians are moving towards owing personal mobility, two-wheelers remain the most affordable and popular choice.

The Indian two-wheeler industry will continue to grow driven by domestic demand for personal mobility.

Key trends shaping the Indian two-wheeler industry.

— The geographic distribution of demand for two-wheelers is changing, driven by structural improvements in the economy and affordability

— Changing user needs and improved affordability are driving changes in vehicle preferences; demand for scooters, premiumization, and performance motorcycles are increasing

— EV two-wheelers are expected to account for 30 percent of overall sales by 2030, reaching 7 million units; scooters are forecast to be 80 percent of the mix

— New business models and ecosystem partnerships are emerging to bridge gaps/ needs that are unique to EVs

Four Interventions that can helps OEM successfully capture the opportunity in the market.

— Expand product offerings and reduce time to market

— Rethink EV GTM and right-size distribution management

— Deepen software capabilities and leverage supply base for product innovation

— Invest in growing the partnership ecosystem and evaluate new business models

More Indians are moving towards owing personal mobility, two-wheelers remain the most affordable and popular choice.

With a population of 1.4 billion and with low average per capita income of approximately $1,900 in 2020, India ranked among the bottom quartile in the global index for affordability. People living in advanced economies rely on four-wheelers for personal mobility, but emerging economies have a high prevalence of two-wheelers. In India, two-wheelers have been the primary choice of personal mobility.

With the economic growth of the past two decades, the country has witnessed a growing preference for owning personal mobility. Nearly 60 percent of all Indian households own a two-wheeler, whereas only 15 percent own a four-wheeler. Two-wheelers are characterized by their low purchase cost, convenience, and efficiency, making them the natural choice for Indians wanting to own personal mobility in both urban and rural environments. While rural India contributed to 70 percent of two-wheeler demand, more recently both rural and urban centers are witnessing increased economic activity, driving the demand for two-wheeler ownership.

Rapid urbanization and economic growth have led to congested cities with significant traffic and parking issues, driving increased demand for two-wheelers. The boom in food and e-commerce deliveries that are heavily dependent on two-wheelers is adding to the demand. Simultaneously, rural India's post-pandemic stimulus, improved agricultural yields, and enhanced infrastructure are driving income growth and commerce, resulting in higher two-wheeler adoption for personal transport.

Based on estimates, there are 230–250 million two-wheelers on Indian roads, with approximately 20 million new vehicles being added every year. The average useful life of two-wheelers ranges from 12 to 15 years.

The Indian two-wheeler industry is a very mature Industry, capable of meeting the domestic demand.

Valued at 21 billion USD in FY 2025, the Indian two-wheeler industry produced about 24 million units, of which roughly 20 million were sold domestically and the rest exported. India is the world's largest two-wheeler manufacturing base, producing nearly 35 percent of the global two-wheeler volume. The two-wheeler industry contributes 15 percent of the automotive industry and generates direct and indirect employment of approximately 4.5–5 million.

India's two-wheeler industry is supported by a reliable domestic supply chain and localized manufacturing. All OEMs in India have developed adequate product engineering and R&D capabilities sufficient for new product and technology development. The industry has successfully implemented BSVI standards and spearheaded the global EV adoption. The EV boom has reshaped the OEM landscape, introducing new-age players that have challenged traditional OEMs with their aggressively priced products and digital-first marketing.

The Indian OEMs continue to invest to improve their technological capabilities and are also adding significant production capacity. Most of these investments are planned for EV scooter manufacturing. A cumulative additional capacity of five million units has been planned by different OEMs in the next five years, signaling their readiness to transition to the next generation of vehicles.



Indian two-wheeler industry: themes to win in the next era of transformation.

The Indian two-wheeler industry will continue to grow driven by domestic demand for personal mobility.

The Indian two-wheeler industry witnessed its strongest growth of 10 percent CAGR between 2009 and 2019, backed by strong macroeconomic growth (see figure 1).

The COVID pandemic broke this growth trend. Movement restrictions and lack of vehicle usage led to a slump in sales for three years between 2020 and 2022.

The industry has witnessed a rebound and is showing strong signs of continued growth for the past two to three years. Two-wheeler sales in FY 2025 numbered 19.6 million units, comparable to the pre-COVID year of 2019. Economic and market stability, income guarantees, increase in first-time buyers, and replacement demand have contributed to this recovery.

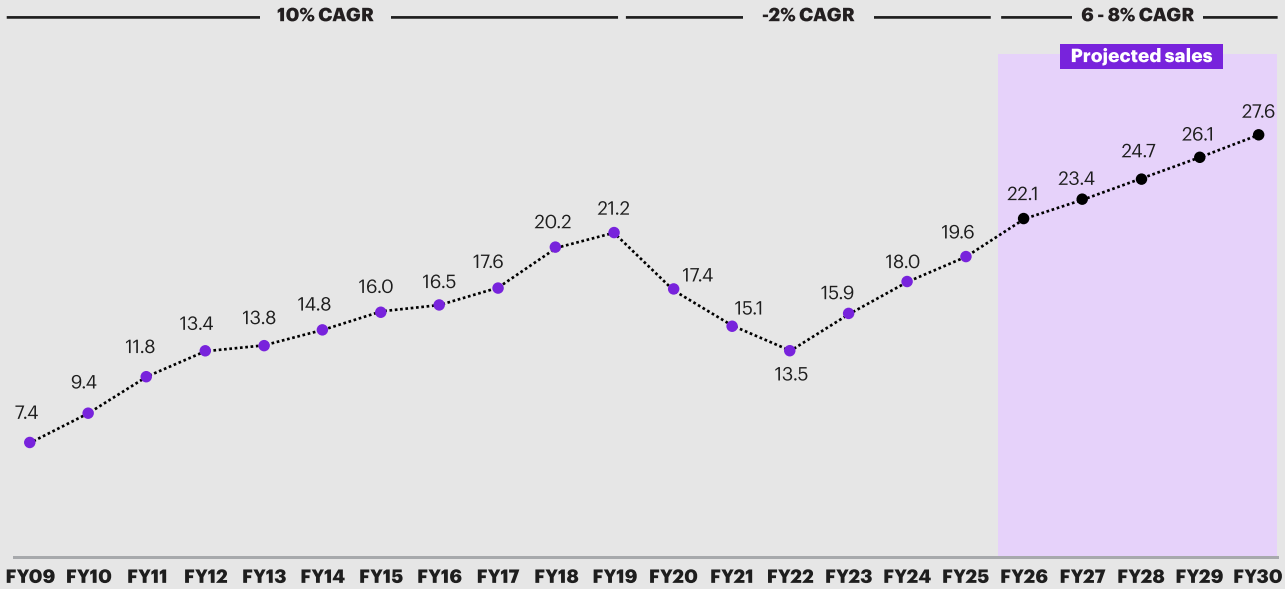
The Indian two-wheeler industry is expected to grow at 6 to 8 percent CAGR until 2030, supported by continued economic progress and favorable demographics. There is further head room for improvement driven by two key factors.

1 **Two-wheeler/household (HH) penetration in India is low.** India's two-wheeler household ownership penetration is at 0.6, ranking much below peer nations such as Thailand (0.9/HH), Indonesia (1.7/HH), and Vietnam (2.0/HH).

2 **The number of HH that can afford to buy two-wheelers is increasing.** The number of households in India is on the rise due to shrinking family sizes, and 50 million new households are expected to be added by 2030. The number of households with income above affordability threshold (INR 275K/year) to buy a two-wheeler is expected to increase from 75 percent in 2020 to 89 percent by 2030.

Figure 1
The Indian two-wheeler market grew at 10% CAGR between 2009 and 2019

Indian two-wheeler market
(in millions)



Source: Kearney analysis

Key trends are shaping the Indian two-wheeler industry.

The geographic distribution of demand for two-wheelers is changing, driven by structural improvements in the economy and affordability.

The two-wheeler industry is witnessing a change in geographic sources of demand, due to shifts in population and increased economic activity in certain geographies.

— **Urbanization is expected to cross 40 percent by 2030, bringing 65 million people toward urban centers in the next five years.**
The economic progress of the past decade has resulted in rapid urbanization. As a result, India's urban population is on the rise. The urban population was 33 percent in 2015, has grown to 37 percent in 2025, and is expected to cross 40 percent of the overall population by 2030. A lack of public transport options is forcing more urban residents to own personal transportation. This continued urbanization will drive demand for two-wheelers in urban centers until 2030.

— **States with historically lower two-wheeler/HH penetration have shown stronger sales in the past two years.**
Two-wheeler sales in the states of Madhya Pradesh, Rajasthan, Bihar, West Bengal, and Odisha are growing two to three percentage points more than most of India's top-selling states such as Maharashtra, Tamil Nadu, and UP. These states are witnessing an increase in economic output and historically had lower two-wheeler penetration per household.

— **The gig and delivery economy will add seven to eight million vehicles to the demand in the next five years.**
The gig economy has witnessed tremendous growth in the past five years. According to Niti Aayog, the sector has witnessed employment growth from 7.5 million jobs in 2021 to 12 million jobs in 2025, with projections indicating 23.5 million jobs by 2030. It is estimated that 30 percent of the gig workers will be delivery agents requiring two-wheelers, potentially driving additional demand of seven to eight million over the next five years.

— **Delivery agents.** Rapid urbanization has also increased e-commerce activity in urban areas. User penetration for online purchases is estimated to be 40 percent of the population and continues to grow. Delivery services for food and grocery are projected to grow at 25 percent CAGR while other e-commerce delivery services are expected to grow at 10 percent CAGR in the next 10 years, driving demand for two-wheelers.

— **Motorcycle taxis.** Growing in popularity, motorcycle taxis offer more convenience and are about 50 percent cheaper over cabs for single-user rides. Informal estimates peg the number of motorcycle taxis in operation at approximately 1–1.5 million. The central government's notification of Motor Vehicle Aggregator Guidelines 2025 will pave the way for formalization of this sector and enable further demand growth.



Changing user needs and improved affordability are driving changes in vehicle preferences; demand for scooters, premiumization, and performance motorcycles are increasing

— **Scooter penetration is expected to reach 40 percent by FY 2030, due to shifting urban preferences and rising female workforce.**
The share of scooters in the overall two-wheeler mix has risen from 30 percent in 2015 to approximately 36 percent in 2025, with further growth anticipated (see figure 2). Demand for scooters has grown due to the increase in the number of women in the workforce, changing preferences of urban users, availability of EVs scooters, and premium internal combustion engine (ICE) scooter models that are suitable for multiple use cases (see figure 3).

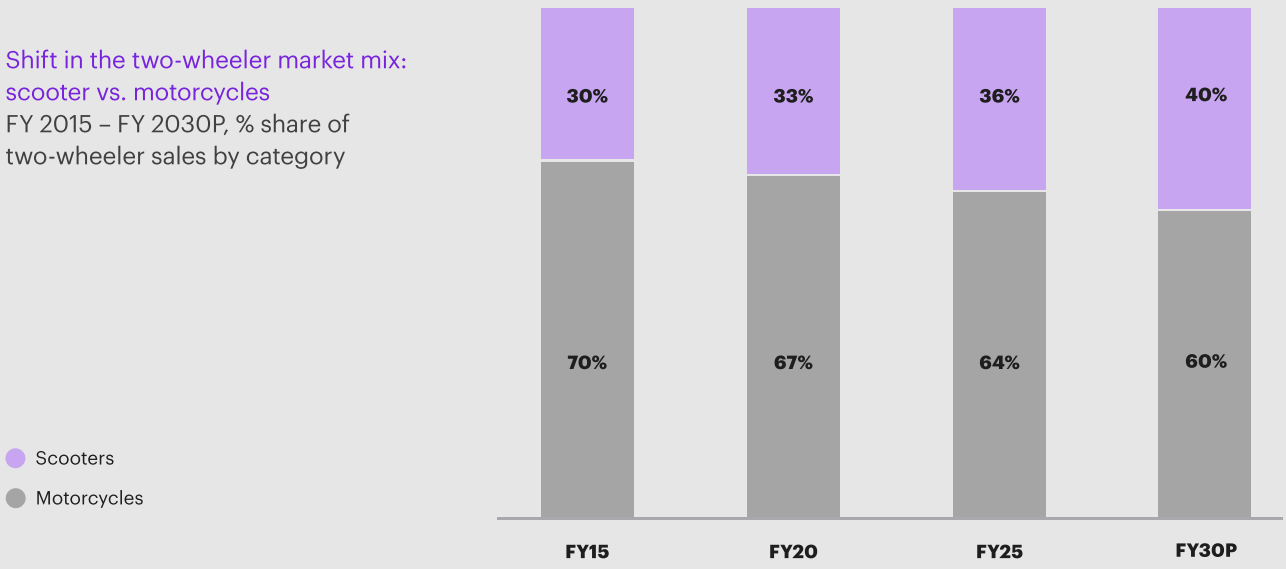
— **There is a 20 percent increase in demand for premium feature-rich derivatives across scooters and motorcycles.**
Buyers are seeking feature-rich scooters and motorcycles. OEMs are reporting up to 20 percent sales increase in these top-end derivates of both scooters and motorcycles, which offer digital clusters, ABS, connectivity, and so on. Feature content of the vehicle has become part of the purchase decision criteria, and consumers are willing to pay the extra 7 to 12 percent premium for higher-end derivates.

— **Motorcycle buyers are increasingly prioritizing performance: the 150cc bike category has grown at 1.5x in the past five years.**
In the past five years, the 150cc performance motorcycle segment has grown from 8 percent of the mix in 2020 to 12 percent in 2025 and is projected to grow to 16 percent by 2030. These higher-capacity models, characterized by stylish and bold looks, appeal to the younger generation of buyers and are often priced higher. Several OEMs are focusing on this lucrative segment by offering multiple models in the 150cc segment, prioritizing it over the lower-engine-capacity offerings.

— **Premium sports bikes (250cc–450 cc) are gaining in popularity.**
The sports bike category (250cc–450cc) has grown from 6 percent of the overall mix to 9 percent in the past five years. In the >250 cc range that caters to the recreational and occasional drivers, OEMs have increasingly introduced global brands through partnerships (for example, TVS with Norton and Hero with Harley Davidson) (see figure 4).

Figure 2
The share of scooters in the overall two-wheeler mix has risen from 30 percent in 2015 to approximately 36 percent in 2025, with further growth anticipated

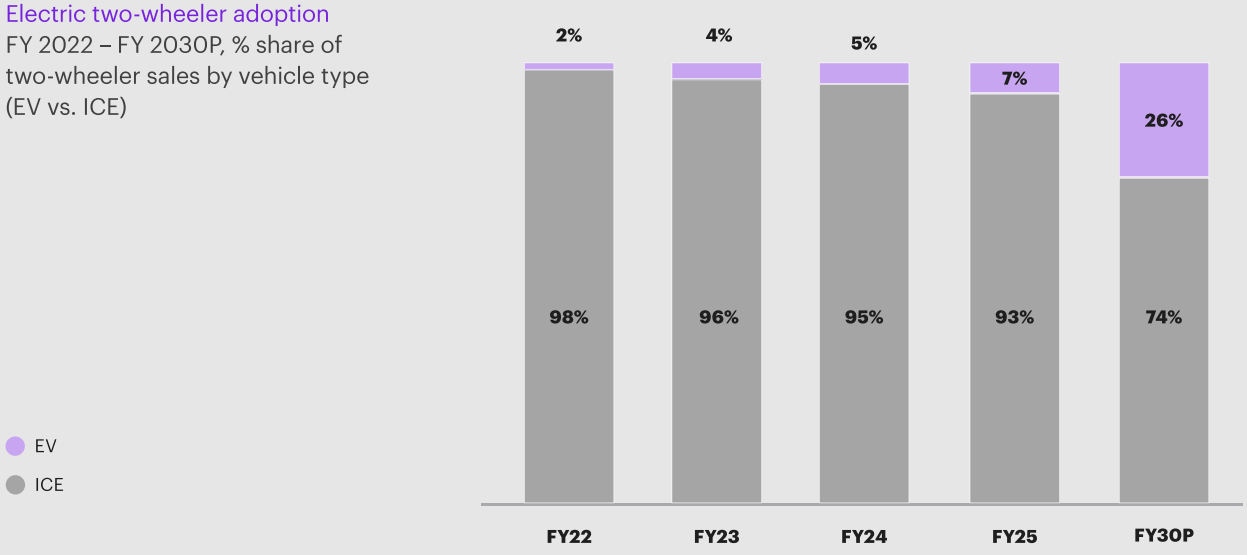
Shift in the two-wheeler market mix: scooter vs. motorcycles
FY 2015 – FY 2030P, % share of two-wheeler sales by category



Source: Kearney analysis

Figure 3
The share of scooters in the overall two-wheeler mix has risen from 30 percent in 2015 to approximately 36 percent in 2025, with further growth anticipated

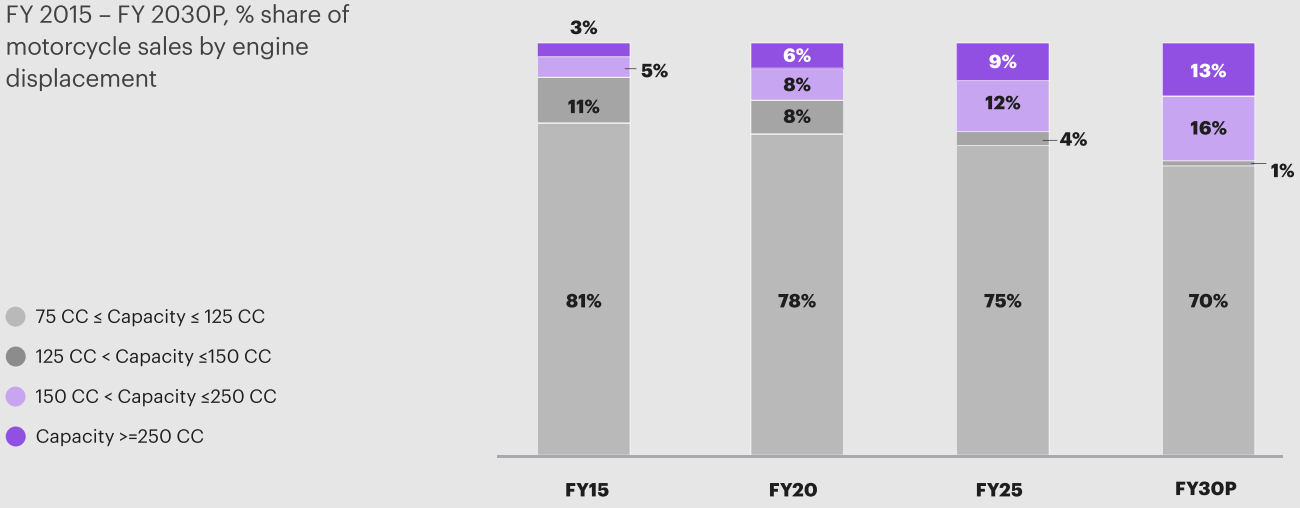
Electric two-wheeler adoption
FY 2022 – FY 2030P, % share of two-wheeler sales by vehicle type (EV vs. ICE)



Source: Kearney analysis

Figure 4
Motorcycles with larger engine sizes are expected to account for a larger share of sales in coming years

Motorcycle sales split by engine size (CC)
FY 2015 – FY 2030P, % share of motorcycle sales by engine displacement



Source: Kearney analysis

EV two-wheelers are expected to account for 30 percent of overall sales by 2030, reaching 7 million units; scooters are forecast to be 80 percent of the mix

Electric two-wheeler (E2W) sales have grown 3.5x in the past three years and currently constitute about 7 percent of the overall sales. E2W adoption has followed the typical growth pattern of successful disruptive technologies, with adoption crossing 5 percent penetration within three years of introduction.

— **Increased E2W penetration will be driven by improved product awareness, diverse and feature-rich product options, superior TCO, and a sustainability push.**

— Increased product offering. Early-entrant OEMs have expanded their model portfolios. Models are available at different price points catering to different usage profiles (basic: 80K INR; mid-range: 100K INR; premium: 125K+ INR). OEMs such as Honda, Yamaha, and Hero Motors are launching new products, further adding to the products on offer.

— Feature-rich. EVs offer more convenience features such as touchscreen display, mobile connectivity, GPS tracking, and functional enhancements like drive modes and safety locks.

— Reducing EV prices and offering superior TCO. OEMs have passed on the benefit of reduced costs of batteries to buyers. EV ex-showroom prices have fallen 15 to 20 percent in the past year and are expected to fall further. EVs have superior TCO compared to ICE vehicles. While ex-showroom prices for EVs are typically 25 to 30 percent more than comparable ICE derivatives, the total cost of operation is 25 to 30 percent lower for comparable drive cycles.

— Sustainability-conscious B2B buyers prefer EVs. Corporates are increasingly considering switching their delivery fleets to EVs to fulfill sustainability goals. Leading e-commerce companies have made ambitious commitments to increase the EV penetration in their fleet: Tata's Big Basket aims for 60 percent EV penetration by 2030, Amazon plans to add 10,000 EVs to its delivery fleet, and Zomato has committed to electrify 100 percent of its fleet by 2030.

— **Salience of software in EV product creation is high.**

— Software plays a crucial role in EVs, significantly impacting their functionality, performance, and user experience. OEMs have leveraged software capabilities to create performance differentiation and enable convenience features.

— Performance differentiation. While EV components are bought out and standardized, OEMs control software and algorithms to optimize charging, torque delivery, and drive modes. OEMs have delivered different range and torque performance on different models with similar hardware using different programming algorithms. Electric two-wheelers are also equipped with software-enabled ride modes that can be selected by the rider by pressing buttons.

— Software-enabled features. Software has enabled integration of several technologies to deliver both functional and experience-based features in EVs such as GPS navigation, Bluetooth connectivity, voice recognition, regenerative brakes, hill hold, electronic throttle control, and safe drive modes. These new features have become key factors influencing customer purchase decisions.

— **EV adoption in tier 2 and 3 cities is growing two to three times faster than in tier 1 and metro cities.**
Tier 2 and 3 cities are witnessing growing penetration of electric two-wheelers (see figure 5). Positive word of mouth on battery performance, home charging, and range ease in urban areas has boosted confidence. This has encouraged residents of tier 2 and 3 cities to switch to EVs. In 2025, Pune accounted for 16 percent while Mumbai 7 percent of Maharashtra's EV sales. Similarly, Surat accounted for 25 percent of Gujarat's sales, while Ahmedabad accounted for 16 percent.

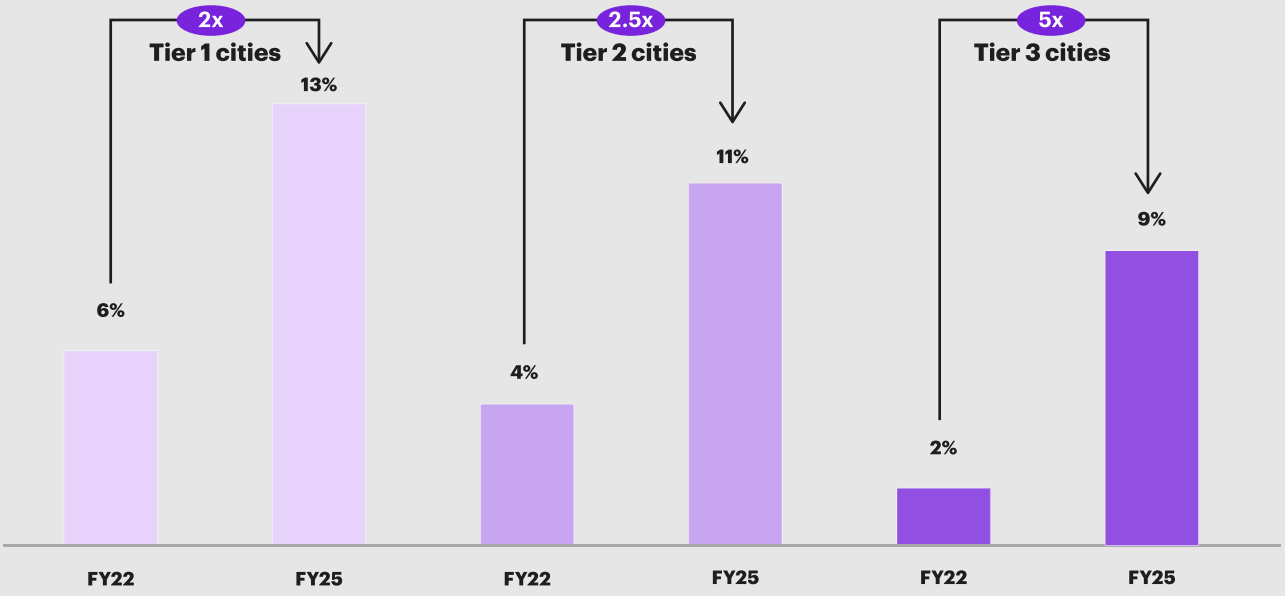
— Scooters will remain a popular option for EVs and will be about 80 percent of the EV mix.

— Demand for electric scooters will remain strong, as electric motorcycles have yet to gain widespread acceptance. EV scooters cater to commuters for short to moderate distances, whereas motorcycles are used for longer-distance trips. Due to range anxiety and limited charging options, electric scooters have become the natural choice due to their urban usage cycle. Many buyers feel that electric motorcycles lack the pickup, power, and resale value of petrol bikes, discouraging adoption among performance-focused riders.

Indian two-wheeler industry: themes to win in the next era of transformation.

Figure 5
The penetration of electric two-wheelers is growing in tier 2 and 3 cities

EV penetration growth in India's cities
FY 2022 – FY 2025, % of overall two-wheeler sales



Source: Kearney analysis

New business models and ecosystem partnerships are emerging for EVs, due to difficulties in financing

Financiers and insurers approach EVs with caution due to uncertainties about the product lifespan, battery life, residual value less battery, and resale mechanisms. Traditional banks and non-banking financial companies (NBFCs) offer lesser loan to value (LTV), shorter terms, and higher interest rates and insurers typically exclude the battery from coverage. This has increased cost of financing and put burden of product failures entirely on the customer. OEMs and start-ups have been developing innovative solutions to these issues with new business models, but challenges prevail.

— **Supplementary insurance for batteries is becoming increasingly necessary to bridge the gaps in financing.**
Seventy-five percent of two-wheeler purchases in India are done through financing. EV financing requires higher upfront payment due to lesser LTVs and increased monthly payouts due to the shorter tenure and higher interest rates. Purchasing an EV priced at approximately INR 125K requires a down payment of approximately INR 35K–40K (without subsidies) and can cost up to INR 3K per month in equated monthly installment (EMI) outflows (see figure 6). The higher cost of EV financing has been a deterrent for early adopters who are very focused on monthly cash outflow.

Figure 6

	Banks		NBFCs	
	EVs	ICE	EVs	ICE
Interest rate	12–18 percent	8–12 percent	15–25 percent	10–20 percent
Loan to value (LTV)	60–80 percent	Up to 100 percent	60–80 percent	95–100 percent
Tenure (months)	12–24	12–60	6–24	12–60
EMI per Lakh (INR) Lowest interest + max LTV + max tenure	~3,800	~2,000	~3,900	~2,100

Most EV insurance policies do not cover battery-related risks. To bridge this gap, new-age insurance companies like ACKO and OEMs such as Ola and Ather have entered partnerships to offer extended battery insurance plans for their customers. These top-up battery insurance policies offer coverage for five years or 60,000 kms.

— **"Battery as a service" is gaining popularity.** Some OEMs offer vehicles without the battery. Under these programs, called "battery-as-a-service," customers pay a monthly lease cost for the battery. Honda and Hero have launched battery-as-a-service programs aiming to replicate the success of these such business models in passenger cars. These lease programs cost customers between INR 700–1,000 a month to lease batteries.

Battery swapping allows customers to quickly swap depleted batteries for fully charged batteries, by subscribing to the platform. An estimated 2,500 battery swapping stations are operating currently, with plans to expand by 130,000 new outlets in the next five years. Honda has launched an e-swap offering battery swapping for its e-Activa customers in Bangalore. Battery Smart and SUN Mobility are private entities, promoting battery swapping for two-wheelers. Success of this model will depend on wider subscription and strategic location of exchange stations.

— **OEMs and charging infrastructure providers are partnering to increase the charging network.** Improving EV adoption will depend on an increase in charging infrastructure at strategic locations across the country, especially in rural areas. An estimated 12,500+ charging stations are in operation in India. This translates to 1 charger per 135 EVs, far below mature market benchmarks of 1 per 6–20 EVs. In the next five years, 130,000 charging stations are planned, but an even more rapid scaling up of private charging stations will be needed to meet the 2030 EV penetration target.

  — Private charging networks. These networks are emerging to address the demand for charging stations. Key players like Tata Power, Charge Zone, Fortum India, Ather Energy, and Jio-bp pulse are rapidly expanding their network of charging points across India.

  — OEM partnership model. Hero has partnered with BPCL while Ather has partnered with Thunderbolt to create charging infrastructure networks at strategic charging locations.

— **E-commerce companies are looking to meet fleet demand with a mix of lease and delivery-agent-owned vehicles.** Platform and delivery-based business models have committed to electrifying fleets, while at the same time are dealing with delivery agent shortages. B2B companies are considering a part of their fleet to be leased in the future. Several start-ups like Quantum Energy and Zypp offer EV fleet rental. Zypp Electric, which specializes in EV fleets, owns 20,000 vehicles and expects to increase the fleet to 100,000 vehicles in the next five years. Food delivery service provider Zomato experimented with 300 lease vehicles in Delhi as part of its study to move to 100 percent EV delivery fleet by 2030. Amazon is targeting to lease 100,000 vehicles for its fleet by 2030.

Indian two-wheeler industry: themes to win in the next era of transformation.

Four interventions that can help OEMs successfully capture the opportunity in the market

The Indian two-wheeler industry is undergoing a transformation. Two-wheelers could account for more than 80 percent of India's personal mobility needs, while also driving zero-emission solutions with its high EV penetration. Navigating this transformative period will require OEMs, suppliers, and distributors to deploy concerted strategies across four key areas.

Expand product offerings and reduce time to market

To seize the opportunity, OEMs must develop a comprehensive product launch plan and time the launches right. This would require attention to both ICE and EV products and finding the right balance in priorities. OEMs must also consider that EVs will eventually cannibalize ICE volumes and determine switch-over points to redirect more of effort toward EVs.

- **Expand product range in EVs and premium ICE platforms.**
  - Expand product offerings to new form factors, price points, and use cases. Products catering to mass-market scooters, a motorcycle form factor, and low-cost entry point options for the emerging B2B segment can unlock up to 50 percent of the overall two-wheeler market for OEMs to target. Large OEMs, both Indian and Japanese, are experimenting with select swappable battery models. Accurate and viable battery swapping network set up will be crucial for next wave of expansion.
  - Premiumize ICE platforms with product market fit. As the Indian two-wheeler market matures, newer variants, performance differentiation, and feature addition are needed in the performance segments (125cc scooters and 150cc motorbikes). Additional models and higher variant mix are needed to be successful in this segment to serve customers who are aware with evolved demand.
- **Accelerate product launches and variant refresh.**
  - Gear product cycle toward shorter refresh cycles and coordinate timing to market trends. The quickly evolving demand with segmental shifts and emerging trends require more variants be made available to offer customers choices. Product development teams should organize themselves to achieve faster development and delivery cycles.
  - Leverage platform strategies to execute shorter time to market. Refreshing products frequently for features will require OEMs to leverage a catalog of ready-to-use feature designs. However, to be successful at this plug-and-play approach, OEMs should have envisioned a feature pipeline vision and must leverage platform/modularity strategies at a vehicle and subsystem level.



Indian two-wheeler industry: themes to win in the next era of transformation.

Rethink EV go-to-market and right-size distribution management

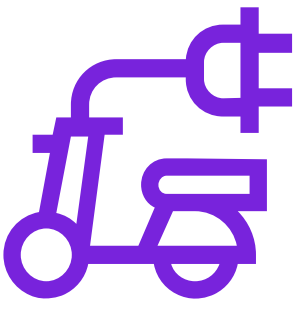
The business models, revenue pools, and existing customer groups for ICE and EVs are different. This necessitates OEMs to think deeply about their go-to-market (GTM) and sales/distribution strategies.

— Right-size the dealership and distribution network. OEMs must model their distribution and dealership network for different growth scenarios and assess capacity at state, district, and town/city level. Legacy OEMs must find a balance between existing dealerships and onboarding new dealers to service new demand centers. Dealer operating models need to be capital- and operating cost-efficient to maintain long-term channel viability. Focus on customer experience and advocacy is a must to build brand reputation and increase market share.

— Reimagine the customer engagement playbook. OEMs are improvising on their customer engagement playbook by changing mix of company-owned/company-operated (COCO) and dealer-owned/dealer-operated (DODO) stores, opening smaller satellite stores, and expanding service footprint. COCO stores are leveraged for brand building, early market development, and establishing customer connect to funnel demand to DODO stores in region. OEMs are taking charge of engagement with customers in the early stage of the customer purchase journey and moving customers to dealerships for touch and feel experiences only.

— Ensure viability of dealerships. Dealers in metro and rural environments will need to operate different models that are right-sized for the market. Rural hubs may not be able to afford the same infrastructure as those in metro towns. OEMs will need to build the necessary support infrastructure for lower-tier dealers, with either a larger dealer or OEM hand holding them for customer acquisition and brand building.

Long-term dealer viability can be maintained by leveraging technology and digital engagement with customer in all sales processes. OEMs that have scaled digital customer engagement have been able realize savings in staffing in dealerships.



Deepen software capabilities and leverage supply base for product innovation

Salience of software in EVs will continue to grow. Software capabilities will enable OEMs to create differentiation and derive revenues from connected services. OEMs can generate incremental recurring revenue streams with subscription services.

Connected mobility to offer personalization and activating new offerings, real-time diagnostics for preventive maintenance, and battery health diagnostics and OTA software updates have become norm. Delivering this will require a technology stack with the right computational hardware and software, vehicle instrumentation, and applications.

— **Invest in native software capabilities.** Traditional OEMs must strengthen their native software development capabilities and enable their tech stack/vehicle architecture toward software-driven vehicles. OEMs must create a pipeline of features to introduce in the vehicle and build hardware capabilities toward future product vision.

— **Shift from process-focused to continuous delivery models.** Unlike conventional engineering processes where products are subject to rigorous testing prior to release, software releases work on real-world testing and constant updates. OEMs must shift toward these continuously evolving software delivery models, synced to real-world usage feedback.

— **Involve, co-develop, and hand hold tier 1 suppliers.** Identify strategic suppliers where technology inputs could bolster software development efforts and who are investing in software capabilities. Obtain their commitment and co-invest in building new hardware and software requirements geared toward the future vision. Tier 1s must also invest in building ahead in reducing external dependence, enhancing software capabilities and testing facilities to secure new OEM business.

— **Leverage specialized software and design service providers to augment capabilities, reduce time to market, and invite new ideas.** External software providers can be a force multiplier if engaged right. Select usage to build UI/UX, human-machine interface (HMI) functions, and cybersecurity and compliance checks, and manage cloud and data platforms at scale to complement in-house OEM talent and capabilities.

Invest in growing the partnership ecosystem and evaluate new business models

The successful scale up of the new EV-focused business models around financing, insurance, and leasing will be key to increasing penetration of EVs. These business models address true customer pain points. While the efficacy and viability of these new business models are yet to be market tested, OEMs must support them to nudge them toward success.

— **Take a call on which partnerships to invest in.** OEMs should engage in discussion with the new service providers and understand the different product offerings and identify those that would complement their product strategy. Where there is complementarity, OEMs should take a call where to invest and how much to invest.

— **Explore a range of options for cooperation.** Invest time and engage in building the right partnership and cooperation model, which will mutually benefit each other. OEMs can leverage access to dealerships for new-age finance/ insurance companies in exchange for priority approvals.

— **Conduct pilots prior to scaling.** Before scaling the partnership engagement, OEMs should invest in pilots and test efficacy of these models. These pilots should be devised to measure the incrementality to sales and customer acquisitions, and degree of customer satisfaction. OEM-sponsored pilot support can also help shape the business models for a tailored solution should there be such opportunities. OEMs should scale the relationship only when complementarity and mutual benefit is established.

Indian two-wheeler industry: themes to win in the next era of transformation.

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Time for Auto Industry to Redefine the NPD Playbook and end This Game of Snakes and Ladders

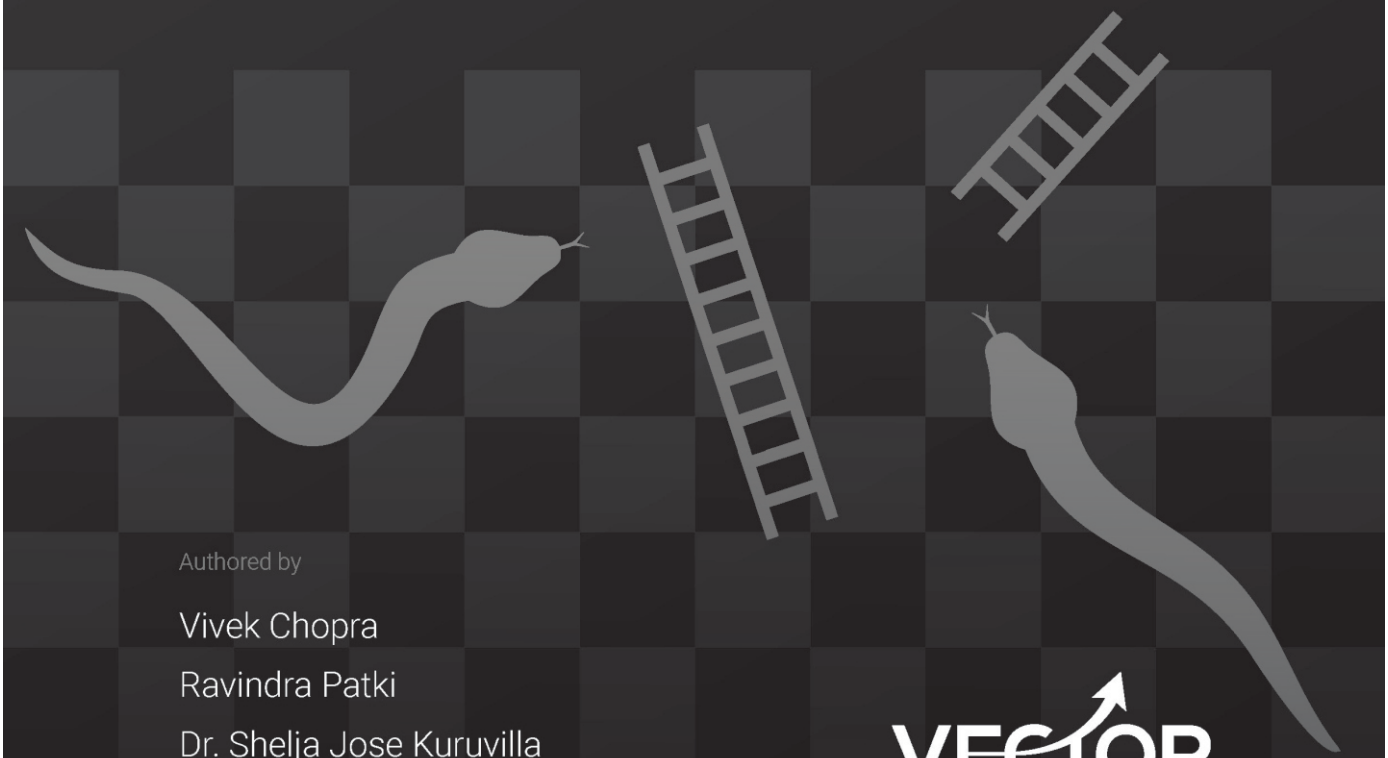
By

VECTOR CONSULTING GROUP



Multiplying **ECNs**

Time for auto industry to redefine the NPD playbook and end this game of snakes and ladders



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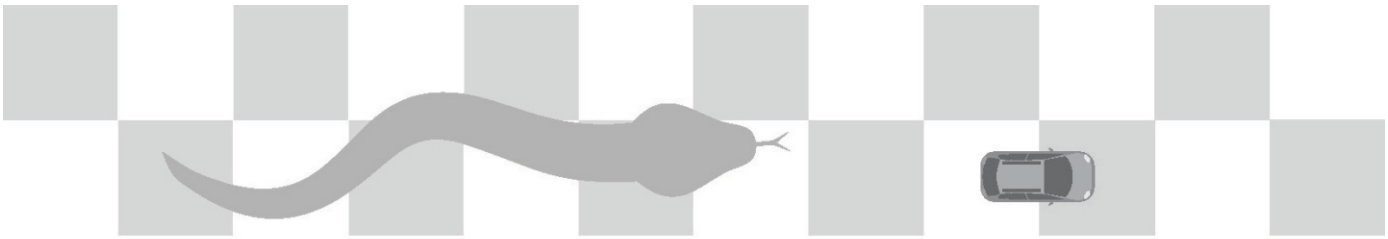

Executive Summary

In the auto industry, no single indicator reveals the health of New Product Development (NPD) better than the pattern of Engineering Change Notices (ECNs). ECNs act as the 'big deal' metric: they determine whether programs are under control or spiraling into delays, cost escalations, quality risks, and organisational stress. The timing and volume of ECNs effectively mirror how disciplined, predictable, and innovation-friendly an NPD system truly is.

Yet in India's auto sector, this vital signal often flashes red. NPD is increasingly playing out like a high-stakes game of snakes and ladders: while OEMs and Tier-1s push toward ambitious launch targets, late-stage ECNs strike like hidden traps, derailing schedules, draining engineering bandwidth, inflating costs, and straining supplier relationships.

Our primary research with 36 OEM and Tier-1 CXOs reveals a stark paradox. ECNs are meant to fuel healthy iteration early in development, but in India, they remain dangerously high well into pilot builds and even post-launch. Ideally, 70%–80% of ECNs should be resolved during the design stage, tapering to less than 8% after launch. Instead, 81% of surveyed OEMs show significant misalignment, with ECNs peaking late in the cycle.

The fallout is severe:

76% of suppliers report lead times ballooning due to late ECNs.

71% face repeated revalidation/ testing, and **62%** must retool moulds.

52% of suppliers admit that delivery targets are missed.

33% of OEMs cite post-launch quality failures.

Warranty costs spike in **20%** of cases, eroding OEMs' profitability and customer trust.

This churn locks the ecosystem into firefighting mode, consuming scarce bandwidth that could otherwise fuel new programs. Strategically, it stalls R&D: 83% of suppliers delay new technology development, while 71% scale back innovation investments, slowing India's aspiration to become an innovation-driven global auto hub.

But there is a way forward. By shifting from milestone-driven management to flow-based execution, anchored in tighter Work-in-Progress (WIP) control, structured triage, early supplier involvement, and stronger Tier-1 leadership, OEMs can deliver measurable gains:

20%–30% fewer late-stage ECNs

30%–50% faster time-to-market

15%–25% more engineering bandwidth freed for innovation

20%–30% reduction in supplier rework and response times

Early convergence is the 'big ladder' that can propel the Indian auto industry towards global leadership. The real question is: **will OEMs and Tier-1s climb it together, or keep sliding down the snakes of late-stage change?**

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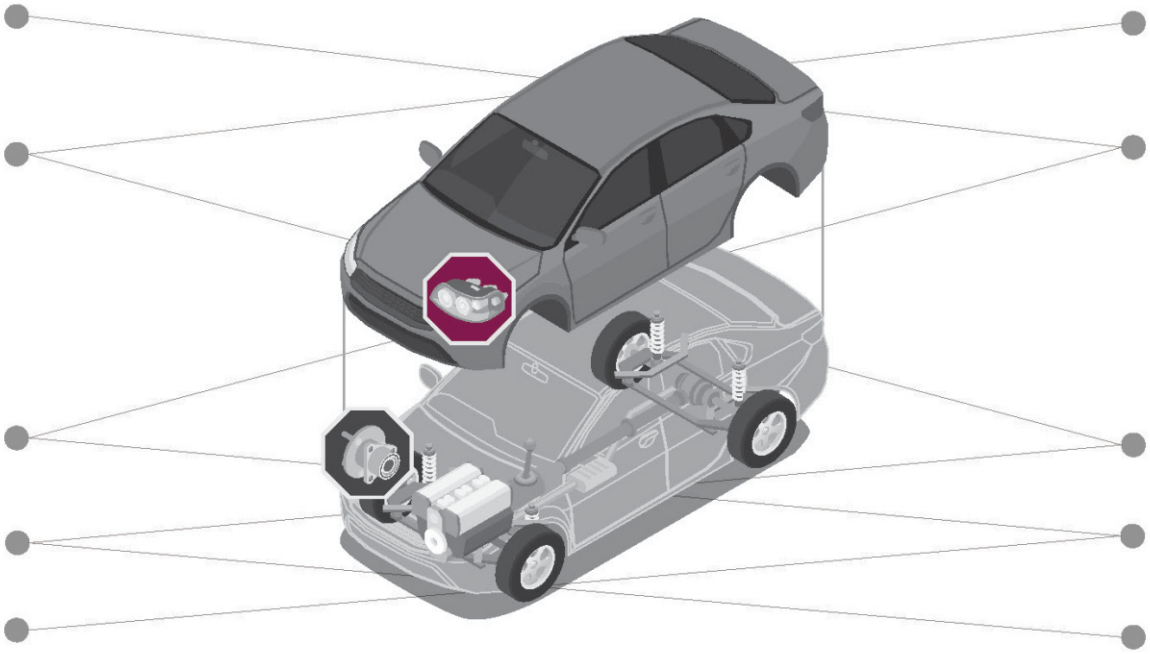
A system built on interdependence

New Product Development (NPD), in any industry, often plays out like a game of snakes and ladders; progress comes in bursts, but a single misstep can send you sliding back. In the auto industry, the stakes are even higher because the game is played by an entire ecosystem. The Indian auto sector is a tightly coupled network where OEMs, Tier-1s, Tier-2s, and Tier-3 vendors must move in sync to bring a vehicle to the market. In such an environment, even minor design changes, whether prompted by manufacturability issues, supplier feedback, regulatory updates, or integration challenges, after a design is released, can trigger cascading disruptions across multiple layers of suppliers and processes. A late-stage change can act like the longest snake on the game board, wiping out weeks of progress through rework, delays, and missed opportunities.

Engineering Change Notices (ECNs) are meant to coordinate revisions and keep the ladders in play. Therefore, they serve as the clearest barometer of NPD health. By capturing, in real time, how well designs, teams, and suppliers stay aligned, ECNs reveal whether change is driven by healthy iteration or by late-stage firefighting. Their timing, frequency, and nature expose risks of delays, cost overruns, and quality lapses that ultimately impact customer satisfaction and market success. Conversely, well-managed ECNs signal disciplined engineering, strong cross-functional collaboration, and proactive risk control, hallmarks of smoother launches, more reliable products, and sharper competitiveness.



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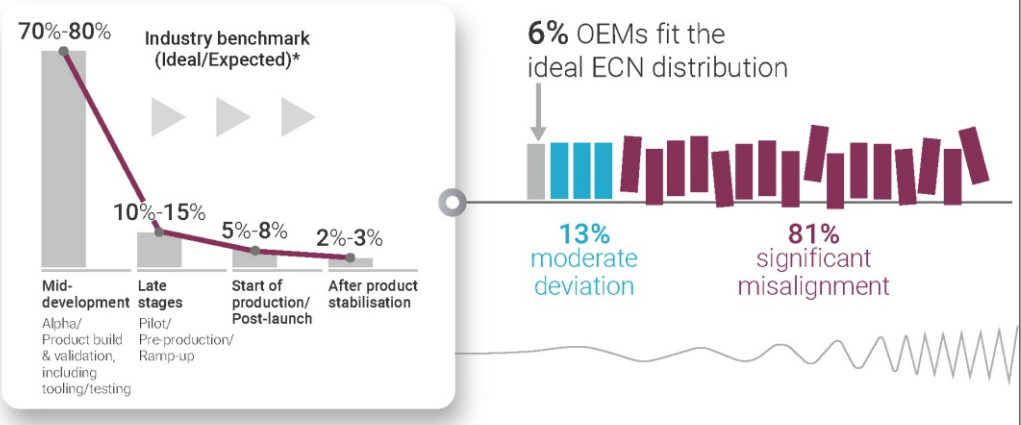
2

The ECN paradox

In a mature NPD process, ECN volumes should drop sharply after design convergence and design freeze, with only minimal and minor changes thereafter. This means that 70%–80% of ECNs should ideally occur upfront, possibly in the design stage itself, then reduce sharply during the transition from design freeze to tooled-up build/validation. Only 10%–15% should arise during ramp-up to pilot, less than 8% at SOP/post-launch, and under 3% after product stabilisation, with these late-stage ECNs limited to small adjustments rather than complex design changes. By contrast, in India's auto industry, ECNs remain significantly high even during late-stage and some persist even into pre-production and ramp-up. This can be seen in the fact that only 6% of the surveyed OEMs fit the ideal ECN trend; 13% show moderate deviation, while 81% show significant misalignment.

Figure 1: Distribution of ECNs across development stages in Indian OEMs



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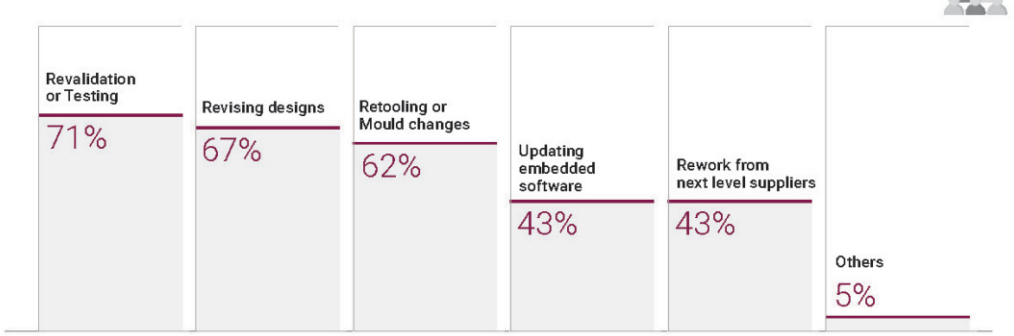
This persistent churn leads to revalidation, tooling changes and supplier firefighting.

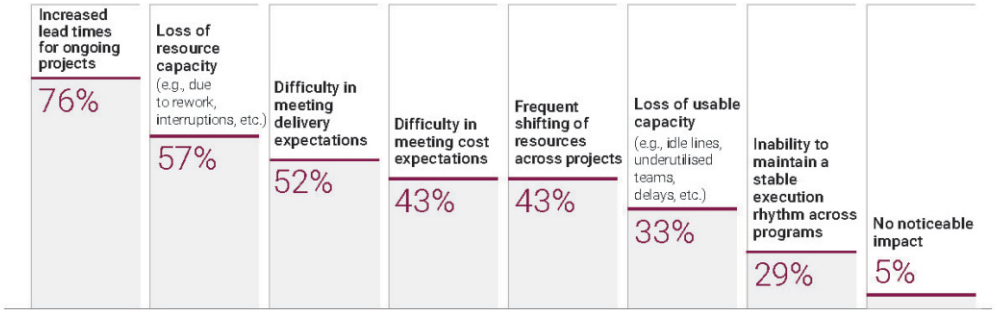
Figure 2: Activities triggered by late ECNs in suppliers



Source: Research@Vector

As specifications continue to shift late into the development cycle, suppliers are left frustrated and in a reactive mode, forced to accommodate moving targets without warning. These repeated adjustments must be made while continuing to support other ongoing programs, leaving teams stretched thin.

Figure 3: Supplier-reported impacts of late-stage ECNs from OEMs



Source: Research@Vector

The absence of a stable execution rhythm and the constant reshuffling of priorities across projects increases project lead times (cited by 76%) and ultimately undermines suppliers' ability to plan capacity (cited by 57%), control costs, and commit to firm delivery schedules. These delays and quality issues often damage supplier scores, prompting OEMs to seek alternate sources for delayed parts. As a result, existing Tier-1 suppliers lose share of business, while the search and onboarding of new suppliers further strain an already overloaded supply chain and NPD teams.

At the OEM, these changes consume bandwidth that could otherwise be allocated to NPD projects (cited by 53%). Ultimately, when the product launches, it often carries vulnerabilities, technical, commercial, or both. These gaps frequently resurface post-launch as quality and reliability failures (cited by 33%), often resulting in higher warranty costs (cited by 20%) and eroding customer trust.

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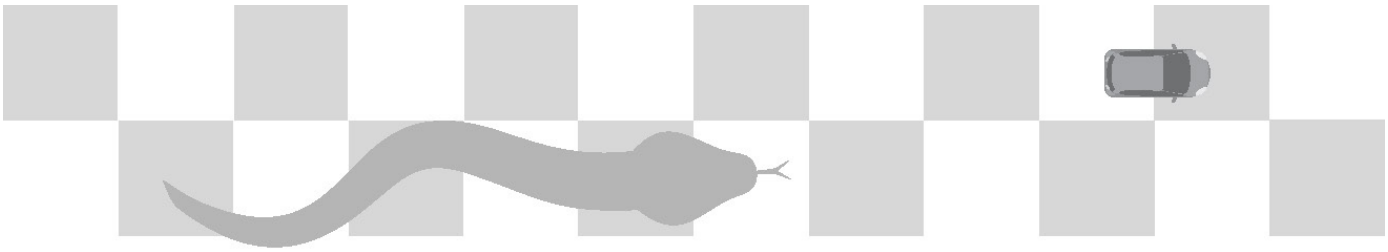
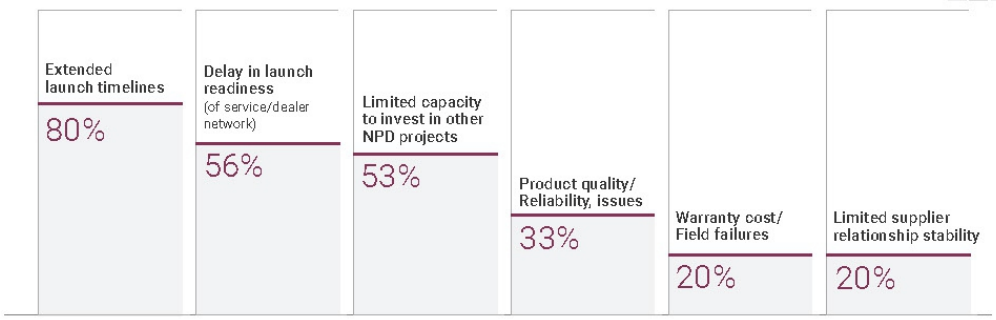


Figure 4: Impact of late ECNs on OEMs



Source: Research@Vector

The challenge intensifies in Software-Defined Vehicles (SDVs). A small change in a proprietary component, such as a sensor or an ECU, can trigger long-tail consequences like embedded code must be rewritten, diagnostics updated, UI/UX revalidated, etc. Each adjustment must be delivered in compressed timeframes. While Over-the-Air (OTA) updates may serve as a temporary fix, they cannot correct fundamental issues introduced by unstable design convergence.

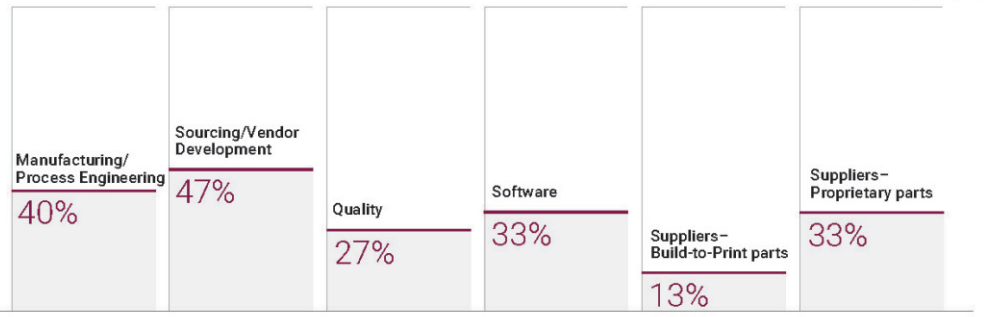


Gaps in early convergence

Effective ECN control depends on early alignment across design, manufacturing, quality, supply chain, software, and supplier teams. Most OEMs recognise this; 40% report that at least 21%-40% of late-stage ECNs could have been avoided with better coordination during the early phases. 93% have formal gate structures in place to support this as well. Yet many still struggle to translate intent into consistent execution.

87% said that RFQs (Request for Quotation) for BTP (Build-To-Print) parts, which make up the majority of the BOM (Bill of Materials) line items, are typically floated only after prototypes are built. Even when floated early, delivery of these parts is often delayed due to vendor capacity or validation bottlenecks, limiting suppliers' ability to influence upstream design. Styling parts are a telling example: they're often sourced early but often arrive late, delaying integration and increasing the risk of last-minute changes. Only a few proprietary Tier-1 suppliers (in 33% cases) are regularly involved from the concept stage.

Figure 5: Entities involved during the concept and prototype stage



Source: Research@Vector

Several real and perceived barriers still prevent OEMs from integrating suppliers into the early stages of NPD. A common concern is the potential loss of negotiation leverage. OEMs worry that if a vendor, especially for BTP parts, is engaged too early, the supplier's input may begin to shape the evolving specifications. This could create a perceived obligation/necessity to award the final order to that supplier, limiting the OEM's ability to negotiate aggressively on cost during the scale-up phase.

This lack of early-stage involvement from necessary teams, manufacturing, engineering, quality, and costing, also happens because each of the teams are already stretched thin by ECNs and demands from other ongoing projects with tight deadlines. New programs also come with their own milestones. Involving multiple stakeholders early will slow down development, adding complexity and coordination overheads, especially when teams feel pressured to secure quick design approvals and show early milestone progress. Moreover, the sheer volume of active projects pushes teams to prioritise deliverables in late-stage programs, consistently taking precedence over early involvement in new ones. Therefore, the early phases of some projects are rushed, often missing critical inputs. Thus, weak early-stage convergence leads to issues surfacing late, triggering more ECNs. These, in turn, consume additional bandwidth, further tightening timelines and reinforcing the cycle.

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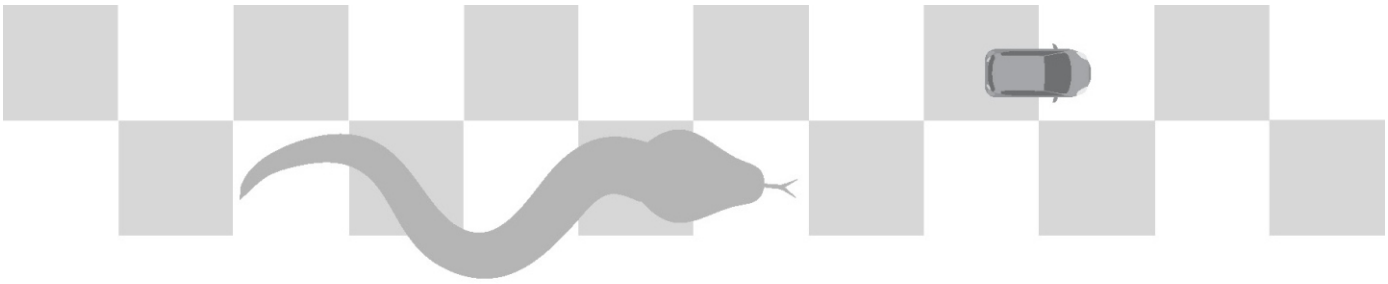

Figure 6: Reported obstacles to early convergence



Source: Research@Vector

Consequently, design freeze happen without maturity. Manufacturability and integration issues emerge too late, when they're costlier and far harder to fix, in terms of time and money.



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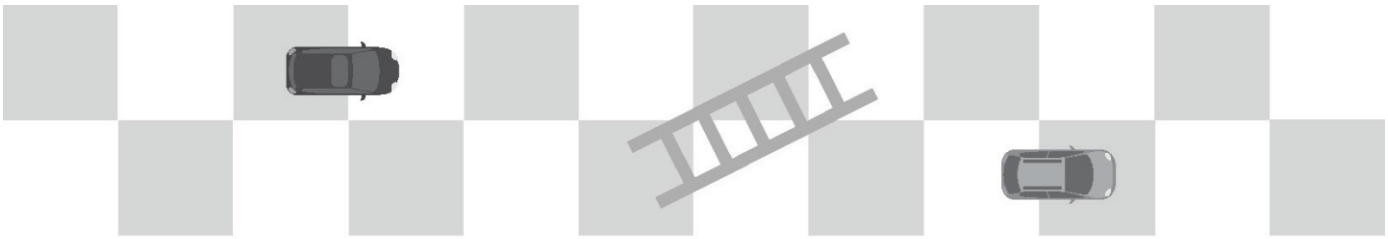


3

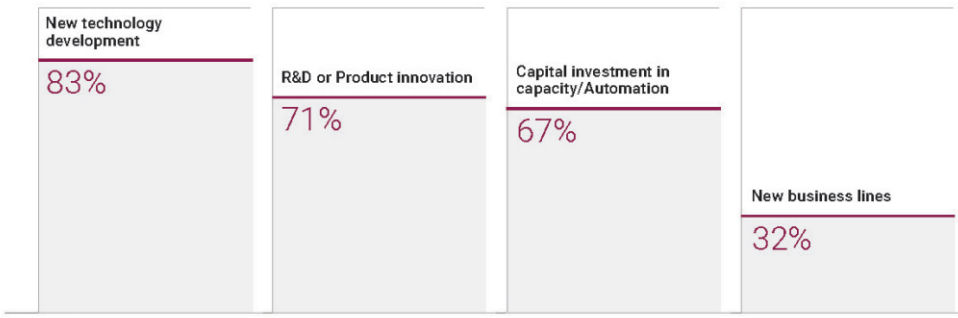
Strategic risks for the Indian auto industry

Over time, this instability and poor reliability don't just affect the short-term performance; they begin to reshape the future of the entire ecosystem.

Suppliers are locked as they are in a cycle of reactive execution and they tend to have little time or capacity for forward-looking initiatives. Strategic investments are delayed or shelved. Innovation takes a back seat to survival.

BTP suppliers, in particular, become uncompetitive, not because their capabilities lag behind, but because they are often unreliable in cost and delivery. Many of these suppliers, despite their willingness, struggle to evolve into proprietary partners and/or risk losing ground to global players in India or abroad who offer greater predictability. Proprietary Tier-1s also suffer: their R&D investments are frequently disrupted by shifting specifications and unstable development cycles. This forces them to postpone or abandon new technology initiatives. As Indian suppliers, many of them MSMEs, are forced to pull back from R&D, the accumulation of local engineering depth and intellectual property slows to a crawl. These firms, already operating with thin margins, find their growth stalled and their competitiveness eroded.

Figure 7: Critical supplier capability undermined by late ECNs



Source: Research@Vector

The result is a gradual hollowing out of the domestic supply base. Instead of evolving into a globally competitive, innovation-driven auto manufacturing hub, the industry continues to lose both value and long-term opportunity.

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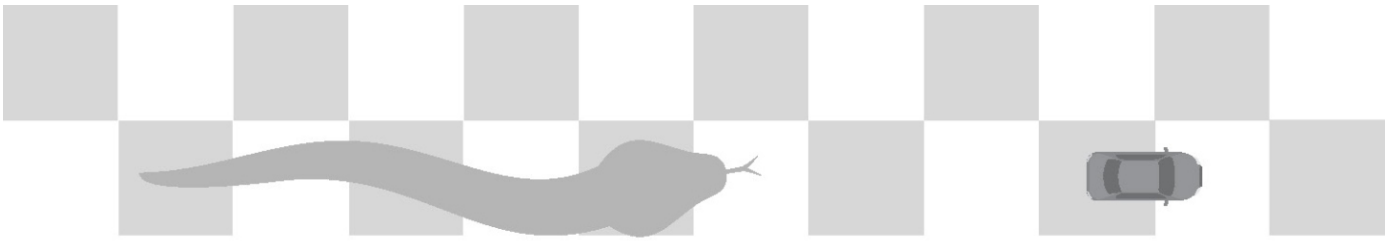

4

The OEM dilemma: Early v/s Late convergence

At the root of this issue of multiplying ECNs is a persistent conflict in product development for OEMs: when to converge.

- **Early convergence** ensures designs are feasible, compliant, and manufacturable, but it demands significant effort to coordinate multiple stakeholders and feels risky, as locking in too soon might reduce flexibility or overlook late-arising inputs.
- **Delaying convergence** keeps options open but pushes hard cross-functional decisions downstream, into pilot or even ramp-up, where changes are costlier and more disruptive.



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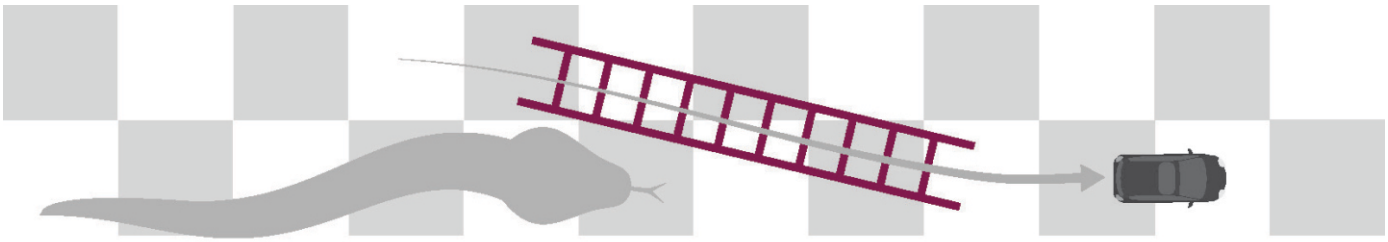

5

The way forward: From milestones to flow



Resolving this dilemma requires redesigning the product development approach itself, across internal functions and external partners. Instead of choosing between 'locking too soon' or 'waiting too late,' OEMs must create the conditions for early, informed convergence without overburdening the teams. The first critical tactic to enable this shift is Work-in-Progress (WIP) control.

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1
Focus on fewer programs to reduce overload and deepen design attention

With too many programs running in parallel, often as much as 3X of what they can realistically manage, cross-functional experts are spread thin, forcing convergence decisions to slip downstream. Therefore, fewer programs have to be worked upon at a time. Limiting the number of active projects, however, shouldn't be based solely on headcount; it must reflect the actual effort and bandwidth needed.

A common misstep OEMs make is assuming that if engineers are available on paper or have open slots on their calendar, they have the capacity to contribute effectively. But true availability depends on the intensity and complexity of the tasks at hand. What's more, even if one team has time, progress stalls if a dependent function, say, process engineering or validation, is already overloaded.

To address this, OEMs should apply WIP limits, not broadly across departments, but specifically targeting high-load, convergence-critical teams such as:

- Manufacturing process teams, who often lack time for early DFMA (Design for Manufacturing and Assembly) inputs
- Sourcing and Vendor development teams, who are consumed by ongoing RFQ (Request for Quotation) activities
- Testing and validation teams, which become late-stage bottlenecks under pressure

This ensures that each design gets the deep, cross-functional attention it needs.

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2
Use structured triage to focus efforts where they matter the most

Even if WIP is limited, priorities can be in conflict. In complex, high-volume environments, it's not uncommon for dozens of change requests, open issues, and design decisions to compete for limited resources within and across teams. In this situation, milestones are not helpful; Triage is.



Triage, borrowed from emergency medicine, is the disciplined process of quickly assessing and ranking tasks by urgency and impact. Milestones tell you when something should happen. Triage tells you what should happen first when everything else can't. Triage frameworks enable teams to:

- Prioritise the highest-impact changes
- Sequence decisions more effectively
- Avoid wasting time on low-priority iterations during crunch periods

This focus ensures that limited engineering and cross-functional bandwidth is allocated to the most maturity-driving activities, moving programs forward rather than sideways.

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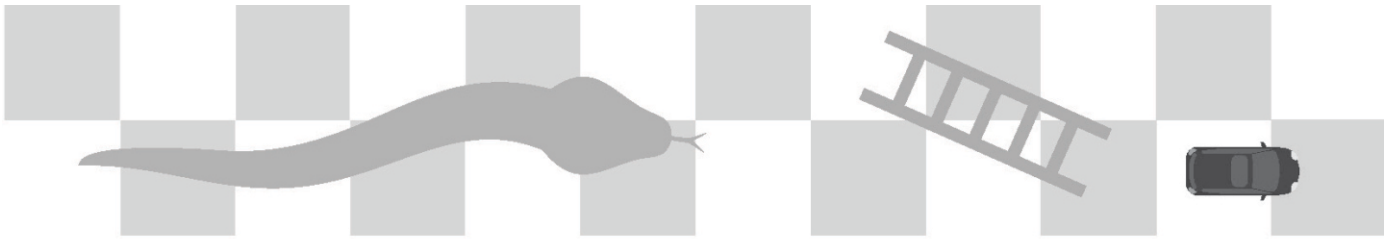
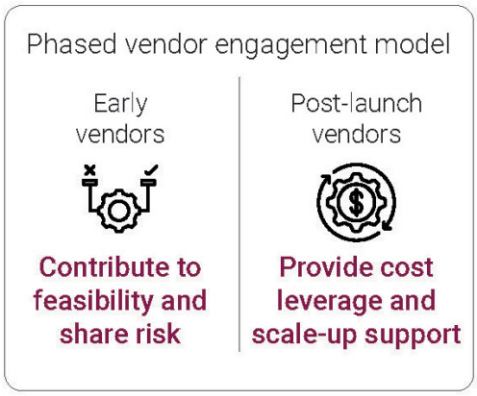


3
Invest more effort upfront to avoid late-stage rework

Another common pitfall of milestone-driven project management is the rush to build prototypes, mistaking speed for real progress. Instead, it's better to invest the time and coordination required upfront so that downstream surprises are minimised and momentum is real.

This begins with building cross-functional bandwidth early. Sourcing, manufacturing, and process teams shouldn't just be responders, they need the space and capacity to influence design decisions before they're locked in. By embedding structured inputs like DFM (Design for Manufacturability), DFA (Design for Assembly), DFMEA (Design Failure Mode Effects Analysis), and DFS (Design for Service) well before design freeze, organisations can catch feasibility and manufacturability issues early, when changes are easier and cheaper to make.

One of the biggest shifts needed is in supplier engagement. Instead of issuing RFQs after prototyping, OEMs must bring suppliers, even build-to-print (BTP) suppliers, into the concept and early design phases. To address concerns around losing bargaining power, a phased vendor engagement model can be used:



For all of this to work, gate reviews must be more than checklist exercises. OEMs need to enforce hard gates for cross-functional inputs before moving into prototyping. These gates should confirm design maturity, feasibility, and supplier alignment, ensuring issues are resolved before execution begins.

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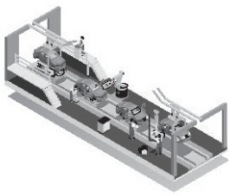
6

Tier-1s must lead, not follow

In this process, Tier-1s have a major role to play. Currently, as discussed, Tier-1 suppliers often find themselves reacting to instability rather than shaping the development process. But they don't have to be passive players. In fact, Tier-1s are uniquely positioned to lead the charge towards a more stable and reliable NPD ecosystem, if they choose to step up.

First, Tier-1s must create visibility into their own true capacity, effort-based and not manpower-based capacity. By doing this early, they can prevent new work from being stacked onto already overloaded teams, avoiding delays that are built into the system by design. Defining capacity in terms of the number of new part developments or projects they can realistically handle also enables them to proactively engage OEMs with confidence in their delivery capability.



Second, Tier-1s should demand structured engagement from OEMs before onboarding, including access to mature designs and stable interface definitions. By insisting on clear specifications and early alignment, Tier-1s not only protect their own timelines but also send more stable, predictable requirements downstream to Tier-2 and Tier-3 vendors.

Third, Tier-1s should invest in themselves to move beyond traditional BTP roles and position themselves as true co-development partners. The shift towards SDVs and increasing product complexity demands such deeper collaboration, not just execution on fixed specs. Crucially, Value Engineering must begin upfront, during development, because when left until later, it becomes a cost-cutting exercise rather than an opportunities to design smarter, more competitive products.

If Tier-1s can consistently demonstrate quality, reliability, and systems-level understanding, OEMs have every reason to bring them in earlier, not just as vendors, but as strategic design collaborators with the ability to influence decisions at an early stage. Such an early partnership enables shared ownership of both risk and innovation.

By taking ownership of minimising ECNs, not only for their own programs but across the broader ecosystem, since even a single change can cascade across suppliers, they reinforce their value as true partners. In doing so, Tier-1s not only face fewer ECNs and reduced volatility but also deepen OEM trust and secure stronger strategic positions in future programs. Just as importantly, this proactive, ecosystem-wide approach fosters a more predictable and resilient supply base, one that supports sustainable growth and continuous innovation across the industry.

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7

The payoff: A system that works

Shifting from milestone-driven tracking to a flow-based model is not just a theoretical improvement; it is a proven operating model that consistently delivers measurable benefits across the product development ecosystem. Companies that have adopted this approach have already realised significant gains:

Smoother cross-functional workflows

By aligning design, process engineering, sourcing, software, and suppliers around flow principles, organisations have reduced coordination delays by **20%–30%**, creating a more synchronised and predictable development rhythm.

Lower ECN volume and disruption

Early convergence and queue control have delivered **20%–30% fewer late-stage ECNs**, particularly post-prototype and during ramp-up. This reduces rework, avoids cascading disruptions, and stabilises launches.

Faster, cleaner launches

By eliminating last-minute churn and bottlenecks, firms have achieved **30%–50% faster time-to-market**, consistently bringing products to launch more reliably and with fewer surprises.

Released capacity across the system

Flow-based execution has freed up **15%–25% of engineering and sourcing bandwidth** previously lost to firefighting and context switching, capacity that is now redirected toward innovation or scaling additional projects.

Improved supplier readiness and innovation

With earlier engagement and better visibility, suppliers have reduced rework and response times by **20%–30%**, while contributing more actively to co-design and manufacturability, strengthening their role as innovation partners.

Stronger OEM–supplier partnerships

Greater stability and trust have led to **10%–15% fewer escalations** from strategic suppliers, building more reliable, long-term collaboration and enabling these partners to gain a larger Share of Business (SOB).

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Thus, if widely adopted, this new operating model, centred on early convergence and flow-enabling tactics, will not only stabilise product development in firms, but will also strengthen India's innovation ecosystem and elevate its global competitiveness. Early convergence acts as the big ladder that propels projects forward, while the other enabling tactics keep them climbing smoothly, avoiding the snakes that can drag progress back.

Together, these shifts position India to emerge not just as a manufacturing base, but as a serious, innovation-led player in the global automotive landscape.

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Appendix: Research design and methodology

Study title: Validating engineering change challenges in the Indian auto ecosystem

- **Study duration**: July 2025–August 2025
- **Sample size**: 36 CXOs (OEMs and Tier-1s)
  - OEMs: Annual revenue ≥₹500 crores
  - Tier-1 suppliers: Annual revenue ≥₹300 crores
- **Screening criteria**
  - Role: OEMs and Tier-1 suppliers only
  - Revenue threshold: ≥₹500 crores (OEMs), ≥ ₹300 crores (Tier-1s)
  - Vehicle segments covered: 2Ws, 3Ws, PVs, LCVs, and HCVs
  - Powertrain exposure: ICE, EVs, and both
- **Methodology**
  - Structured quantitative survey with logic-based routing and built-in validation.
- **Response mix**
  - By organisation type: OEMs - 42%, Tier-1s - 58%
  - By segment: 2Ws - 27%, PVs - 53%, LCVs - 13%, and HCVs - 7%
  - By powertrain exposure: ICE - 20%, EVs - 20% and both - 60%
- **Data handling**
  - All responses were anonymised and aggregated.
  - Multiple answers were permitted for multi-select questions.

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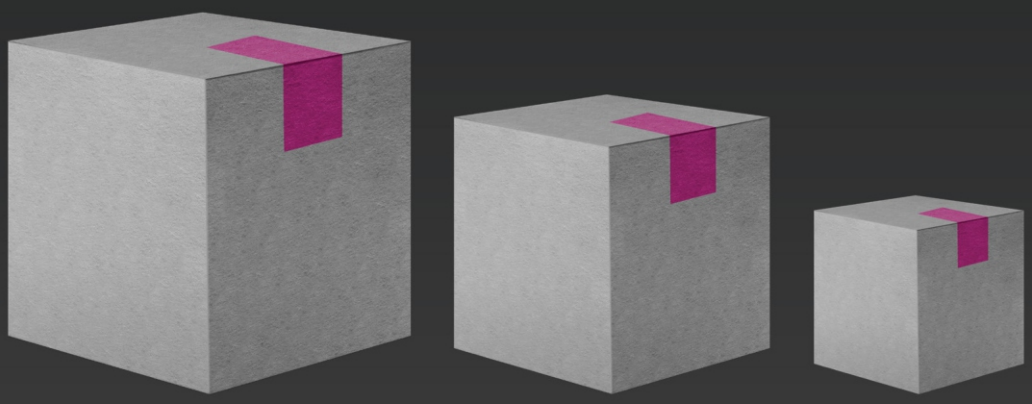

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With advanced wire processing, press, and resin molding technologies, we deliver high-quality, cost-efficient products with reliable on-time supply. Our expertise extends beyond seat components to interior and body parts, supported by overseas production bases.
By integrating development, design, and manufacturing, we strive to create innovative solutions while contributing to a sustainable future.



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Since our founding, we have specialized in seat component processing, particularly excelling in wire and spring manufacturing, both in quality and volume. With press forming and welding capabilities, we are able to handle integrated production from individual components to complete seat frames, earning high praise from our customers. Our operations are guided by the Toyota Production System, enabling highly productive, small-lot, multi-model manufacturing.



Development

As a comprehensive manufacturer of automotive components, not limited to seat frames, we leverage our accumulated technical expertise to develop new methods that improve seat comfort while reducing costs, as well as new products such as heat-shielding interior curtains. Our strong development capabilities allow us to continuously meet customer needs and explore new product designs and manufacturing techniques.



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Handling a wide variety of car models, we have learned from the quality assurance methods of numerous automakers and applied these insights to achieve high-quality mass production. By utilizing our knowledge of metal parts, welding technologies, and interior resin and fiber materials, we provide reliable, high-quality products that earn the trust of our customers across a diverse range of automotive components.













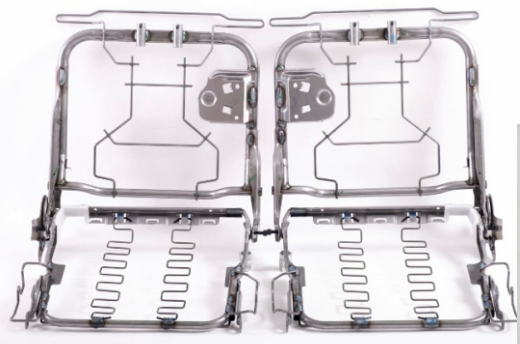



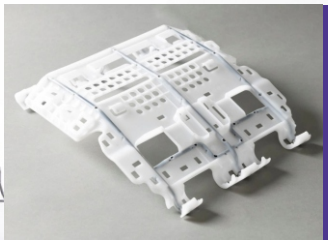



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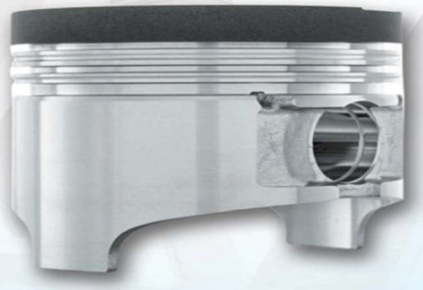





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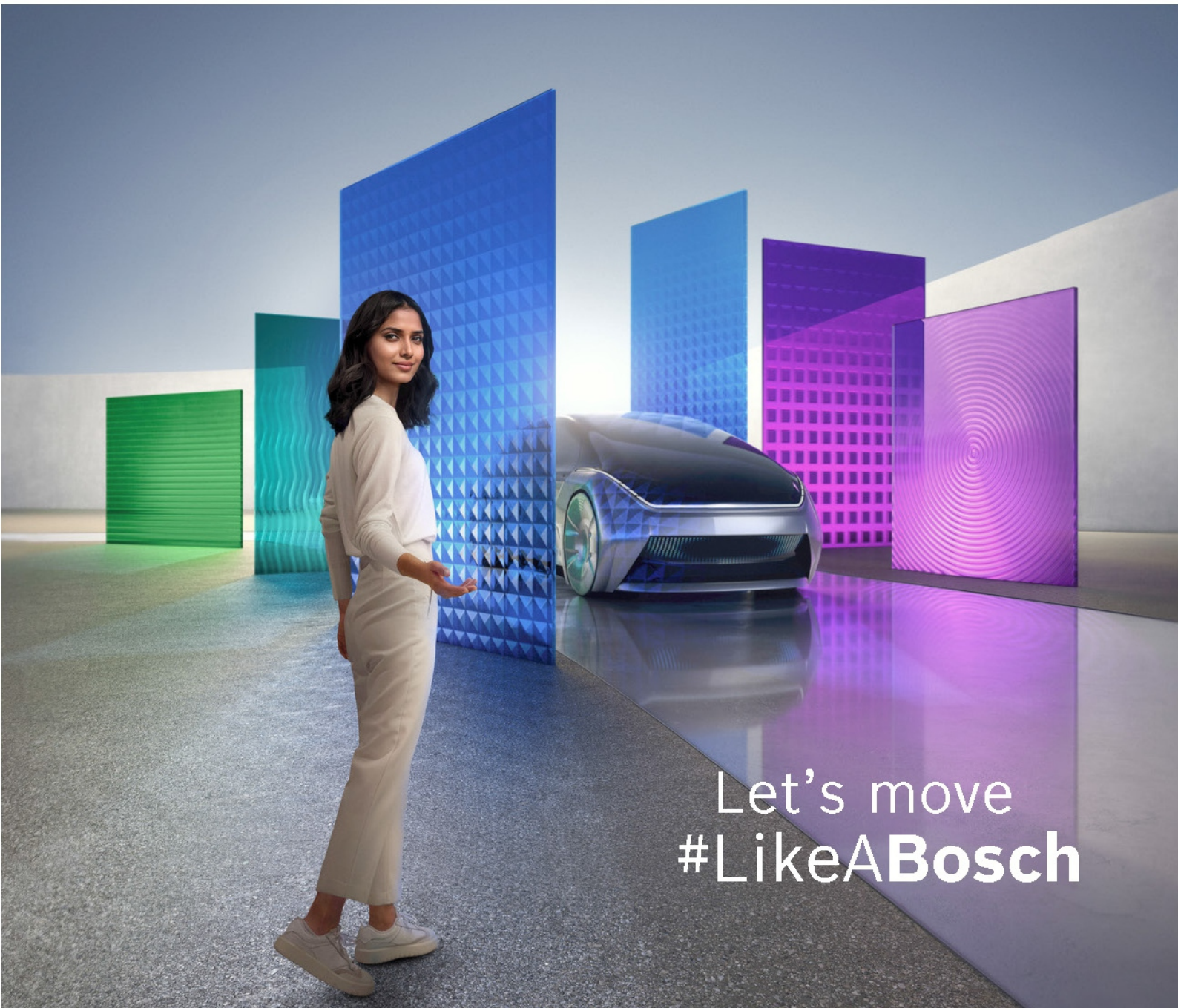

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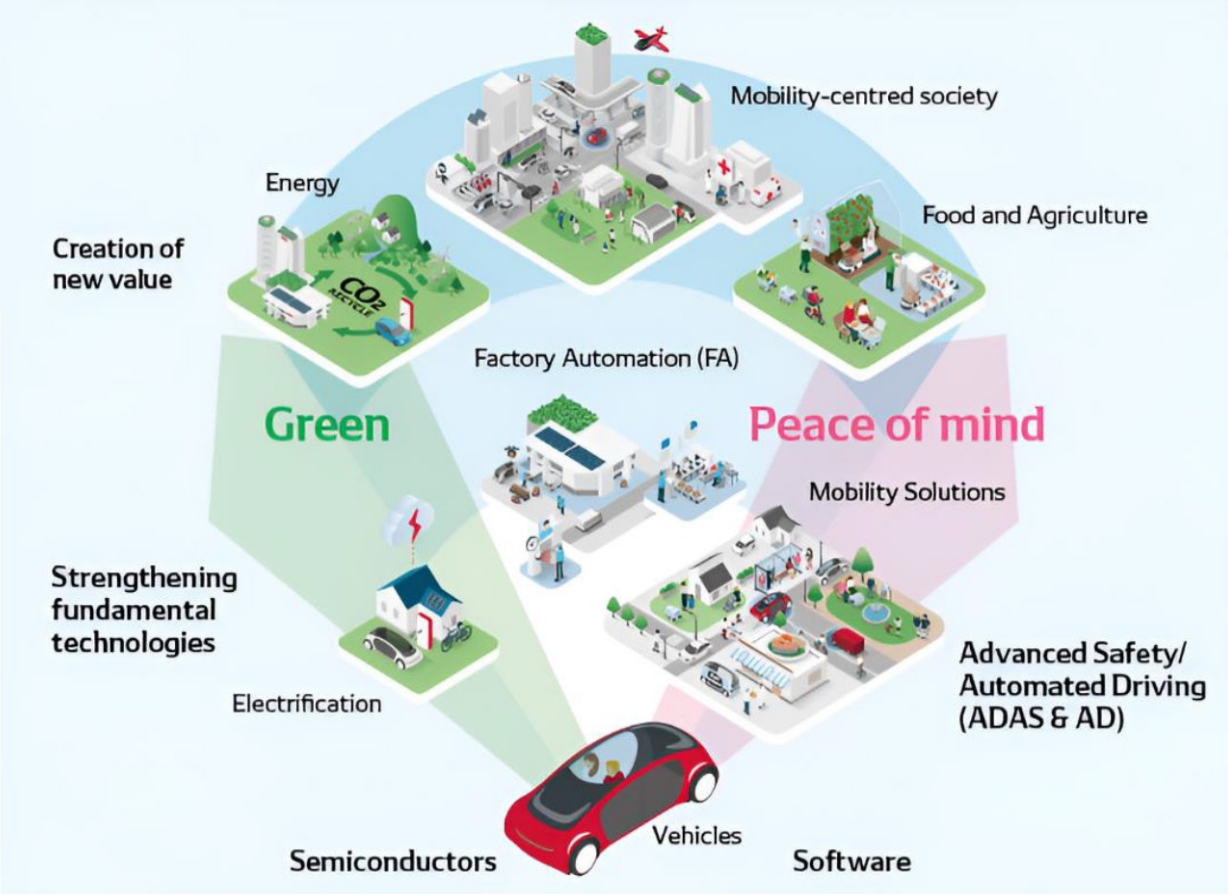

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1955: Foundation stone being laid for Fenner Cockill Ltd, at Madurai



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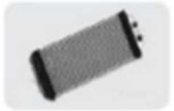
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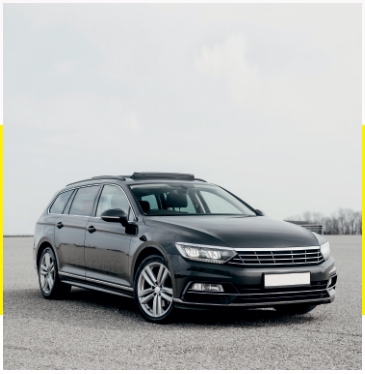





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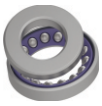
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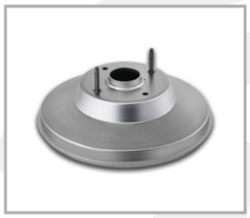

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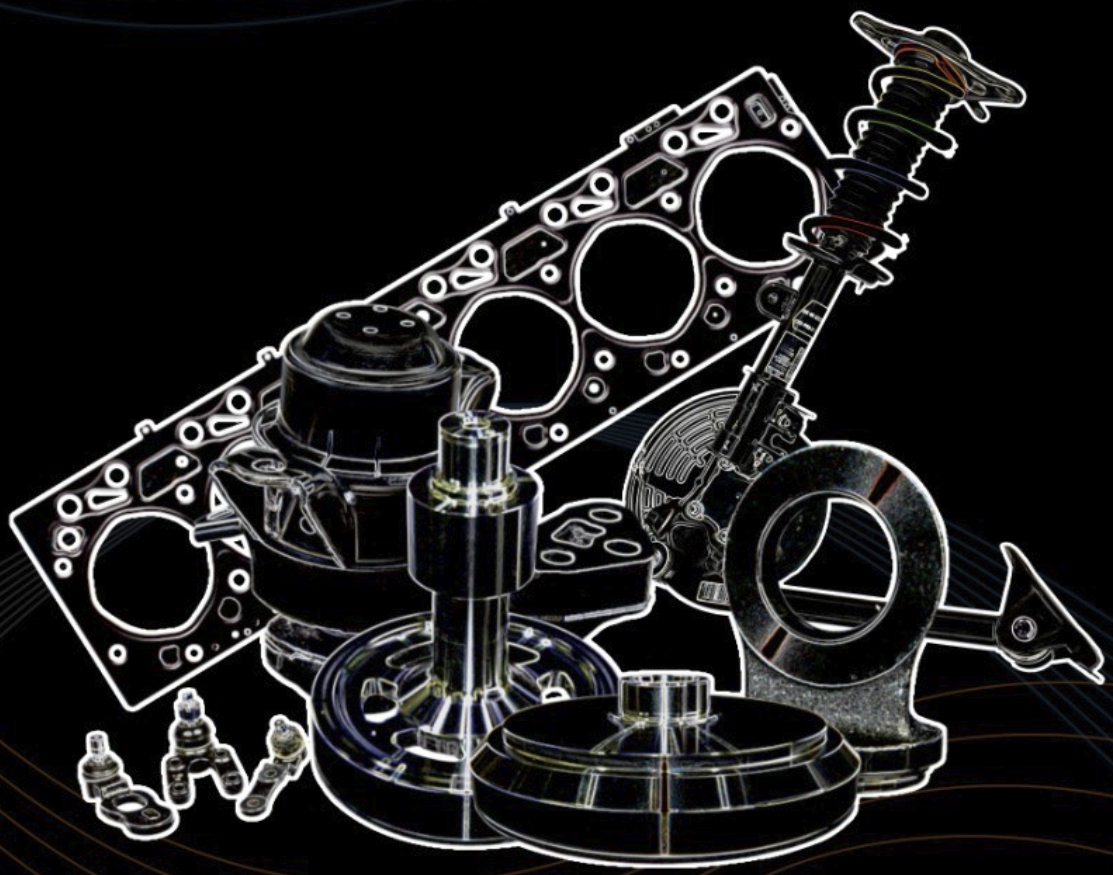

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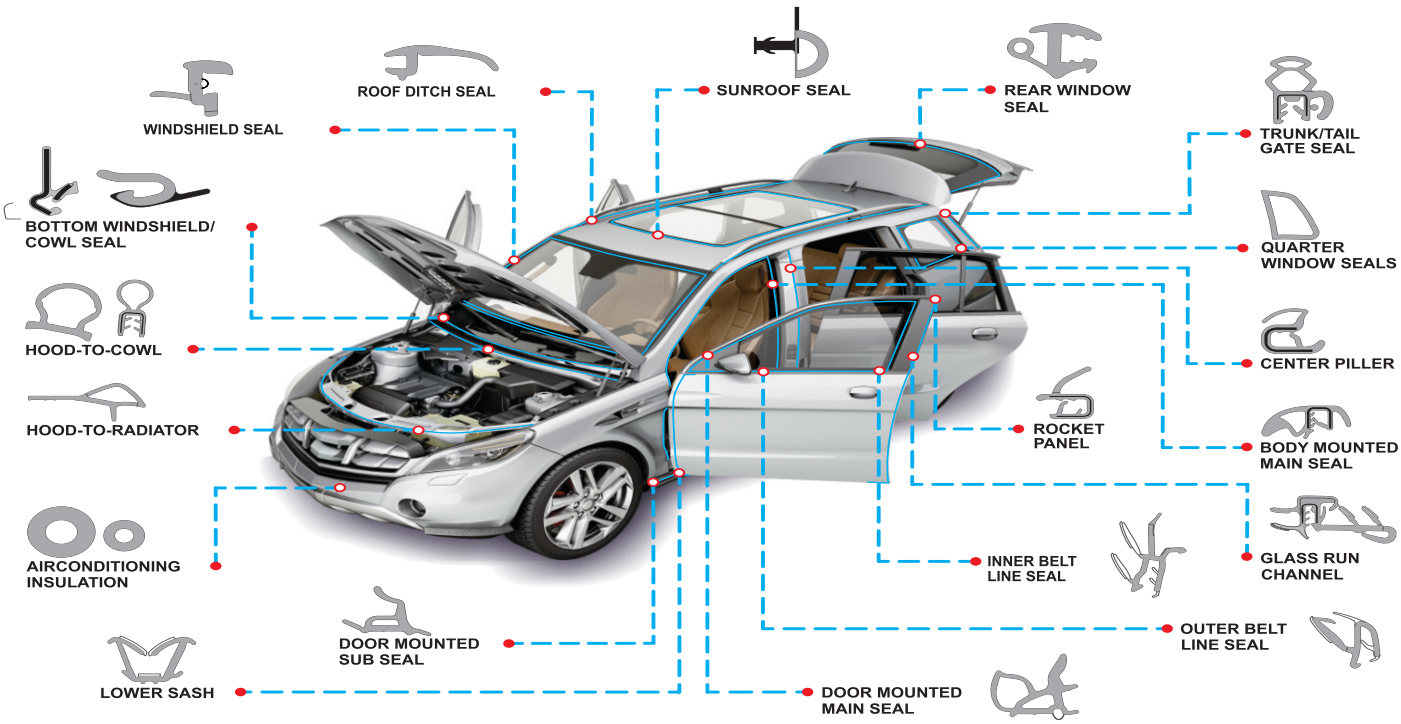

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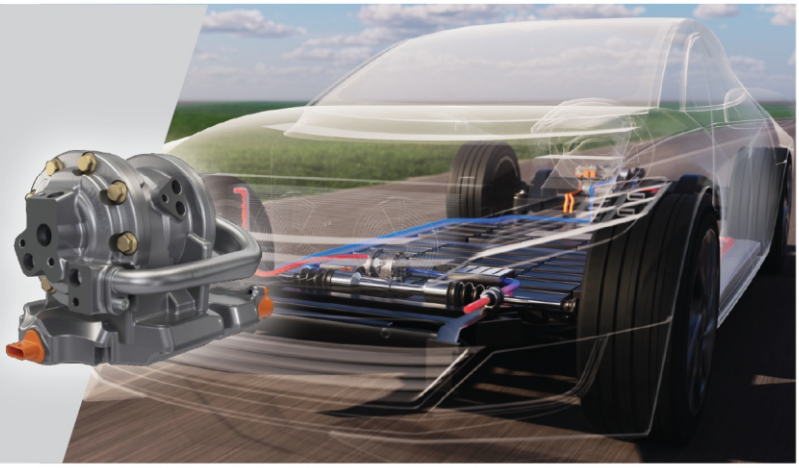

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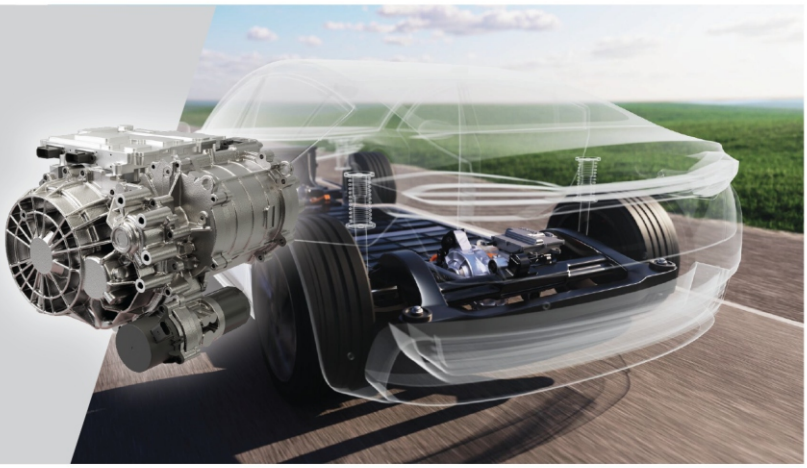
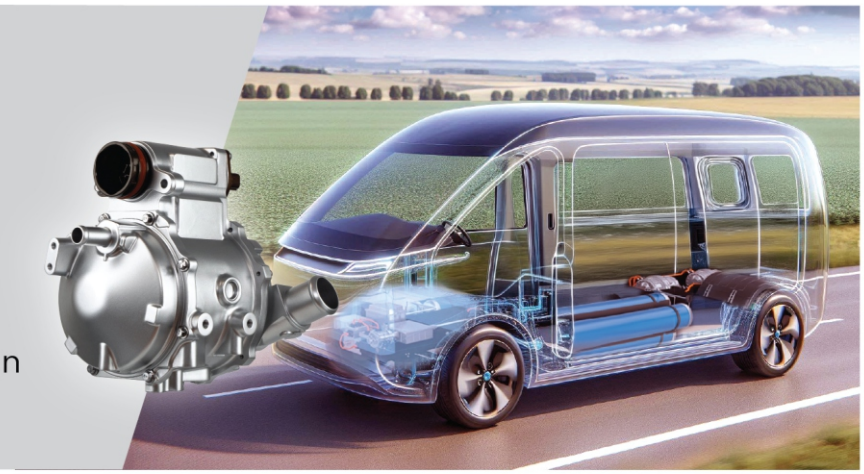


Hydrogen Fuel Cell Compressor

Optional turbine expander uses 20% less power, while ultra-high -speed (>150 krpm) ensures a compact, high-performance design with maximized efficiency.



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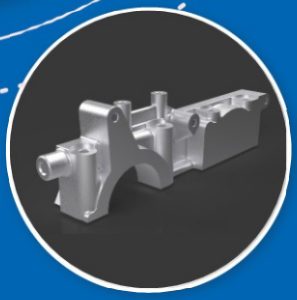

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In the heart of India's industrial landscape, Jayaswal Neco Industries Limited stands as a beacon of innovation, quality, and sustainability in the alloy steel and castings sector. With over five decades of excellence, the company has grown from a modest foundry to a powerhouse in India's steel industry, driven by the visionary leadership of its founder, Shri Basant Lall Shaw.



A Journey Rooted in Vision:

The story of Jayaswal Neco began in 1972, amidst the socio-political turbulence of Kolkata. Shri Basant Lall Shaw, with remarkable foresight, relocated to Nagpur, leveraging its strategic central location to establish a foundry focused on municipal and railway castings. This move laid the foundation for a robust distribution network across India, setting the stage for the company's meteoric rise. His ambition to innovate and diversify transformed the fledgling foundry into one of India's leading manufacturers of iron and steel castings.



Pioneering Growth and Diversification:

In 1996, Shri Basant Lall Shaw took a transformative leap by establishing a state-of-the-art Integrated Steel Plant at Siltara, Raipur. Further solidifying its self-sufficiency, the company acquired iron ore mines in Chhattisgarh, enabling seamless raw material supply and positioning Jayaswal Neco as a fully integrated player in the steel industry. This strategic expansion not only met India's growing industrial demands but also opened doors to international markets, cementing the company's global footprint.



A Legacy of Excellence:

Today, Jayaswal Neco Industries Limited is synonymous with quality, innovation, and sustainability. Its operations span three key pillars:

Integrated Alloy Steel: The company's 1 million tonnes Per Annum Integrated Steel Plant, supported by captive mines, produces high-quality iron and a diverse range of alloy steel products. With a focus on sustainability, high productivity, and optimal resource utilization, Jayaswal Neco caters to dynamic industrial applications, from Automotive, Defense, Engineering, Bearing, Oil & Gas, Railways and Power sector.

Castings: As a leading producer of iron and steel castings, the company serves industries such as construction, engineering, and automotive. By leveraging cutting-edge technologies, Jayaswal Neco continuously introduces innovative products that align with evolving industry standards and customer needs.

Mining: The company's mining operations reflect its commitment to sustainable practices and self-reliance. With two major iron ore mines, alongside reserves of titaniferous ore and limestone, Jayaswal Neco ensures a steady supply of raw materials, supporting its diverse production capabilities.



Commitment to Quality and Sustainability:

Jayaswal Neco Industries Limited excels in delivering Alloy Steel Long Products and Iron & Steel Castings that embody reliability and innovation. The company's unwavering focus on quality ensures that its products meet the highest industry standards, while its eco-friendly practices promote a sustainable future. By balancing industrial growth with environmental responsibility, Jayaswal Neco continues to set benchmarks in the steel and castings industry.

A Trusted Partner for a Dynamic Future:

With a legacy built on ambition, innovation, and excellence, Jayaswal Neco Industries Limited remains a trusted partner for its diverse clientele. From tailored solutions to cutting-edge products, the company is poised to drive India's industrial progress while contributing to a sustainable and prosperous future.





Mr. Avneesh Jayaswal
Group Director







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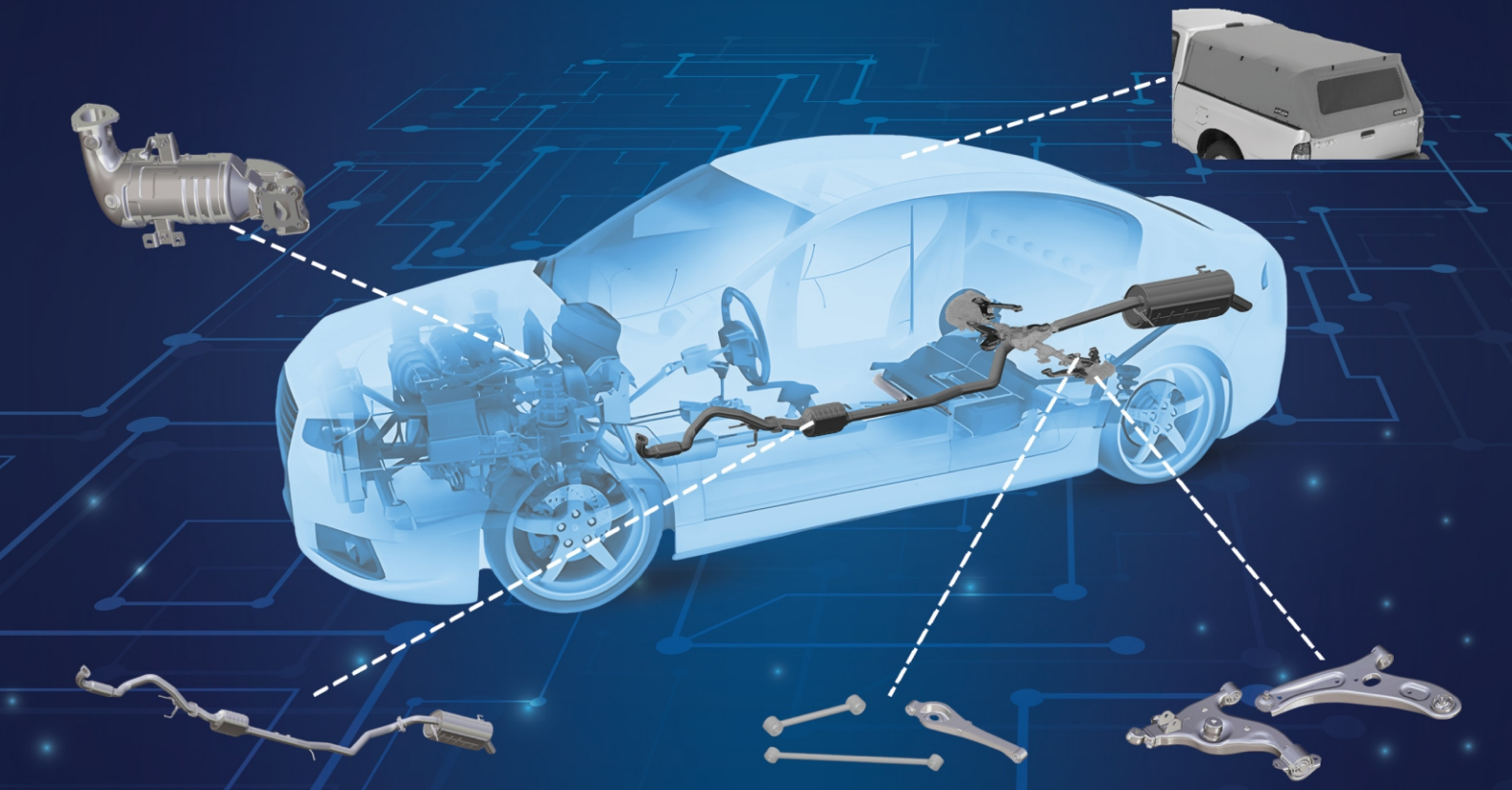

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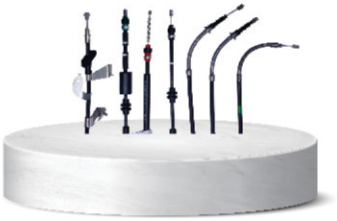

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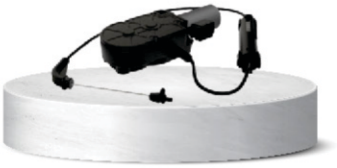

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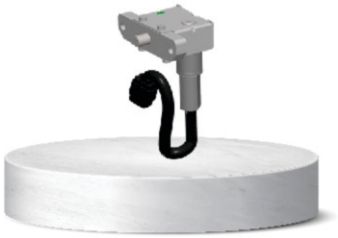

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