

Assessment of Advanced Braking Systems, Aluminium Lightweighting Precision Solutions and Safety Control Cable Segments

January 2023

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Overview of global economy

Review of and outlook on economic trends and inflation in key countries

Just as the world was recovering from challenges heaped by the Covid-19 pandemic, an expected strong recovery was truncated by Russia’s invasion of Ukraine in early 2022 and consequent rise in energy and commodity prices. After the initial shock, there was some improvement in global economic indicators in the second half of 2022. Indeed, concerted effort by major central banks over 2022 seems to have stemmed inflation to some extent while preventing any major economic slowdown. Still, the global economic outlook is projected to be lukewarm for the medium term.

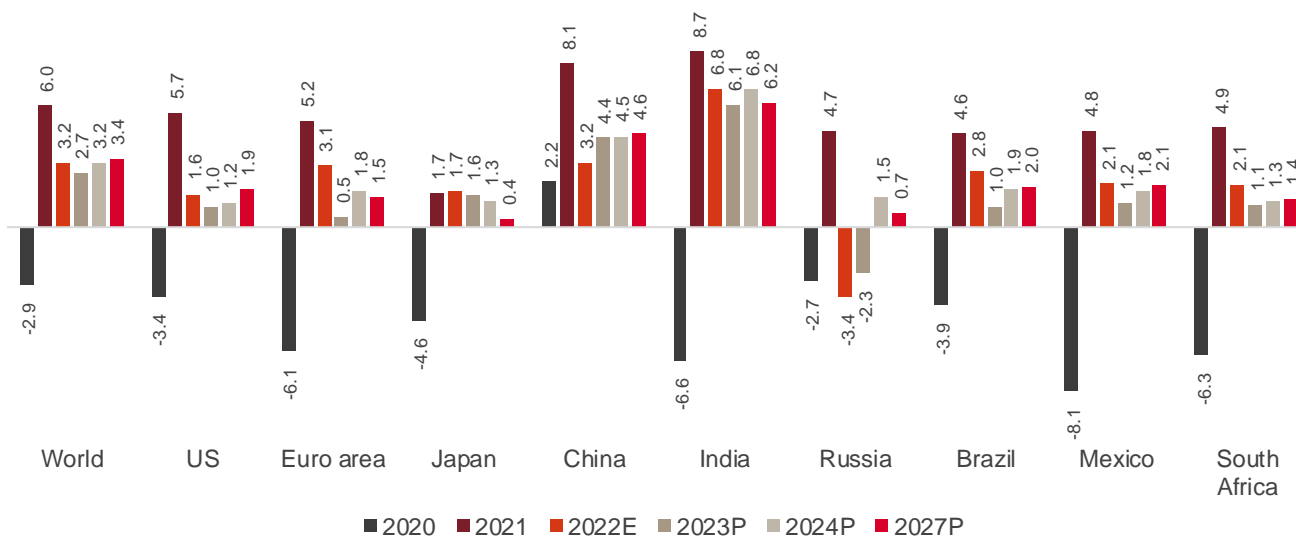
Global inflation and growth trajectory

The geopolitical shock following the Russia-Ukraine crisis has had ripple effects, most visibly in energy and commodity prices. Prices rose sharply over fears of supply disruption from Russia, given its status as the second largest exporter of crude oil globally, with prices continuing to climb as advanced economies imposed economic sanctions on Russia – Brent crude briefly crossed the \$130/barrel mark in early March 2022. Base metal prices (particularly that of non-ferrous metals such as aluminium and nickel) also jumped owing to Russia’s position as a significant producer.

The International Monetary Fund (IMF) estimates that the global economy grew at 3.2% in 2022 compared with 6.0% growth in 2021.

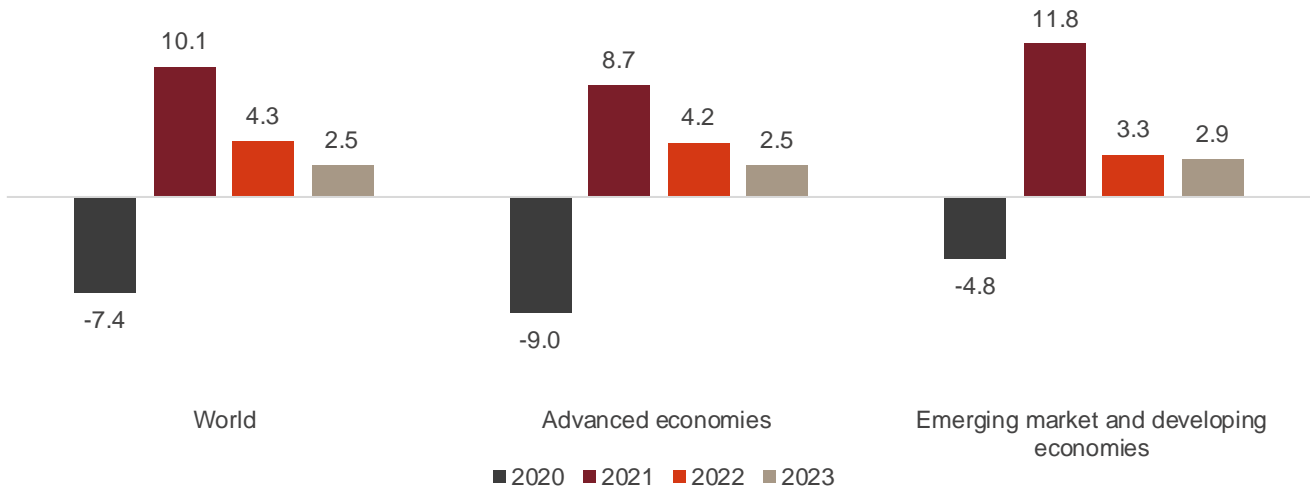
India is expected to remain a growth outperformer over the medium run. We expect India’s GDP growth to average 6.6% between fiscals 2024 and 2026, compared with 3.1% globally — as estimated by the IMF. India would also outpace emerging market peers such as China (4.5% growth estimated from 2023-25), Indonesia (5.2%), Turkey (3.0%) and Brazil (1.6%).

IMF GDP projections for key economies



*Euro area includes 19 countries of the European Union
Source: IMF (World Economic Outlook – October 2022 update), CRISIL MI&A

IMF estimates of world trade growth

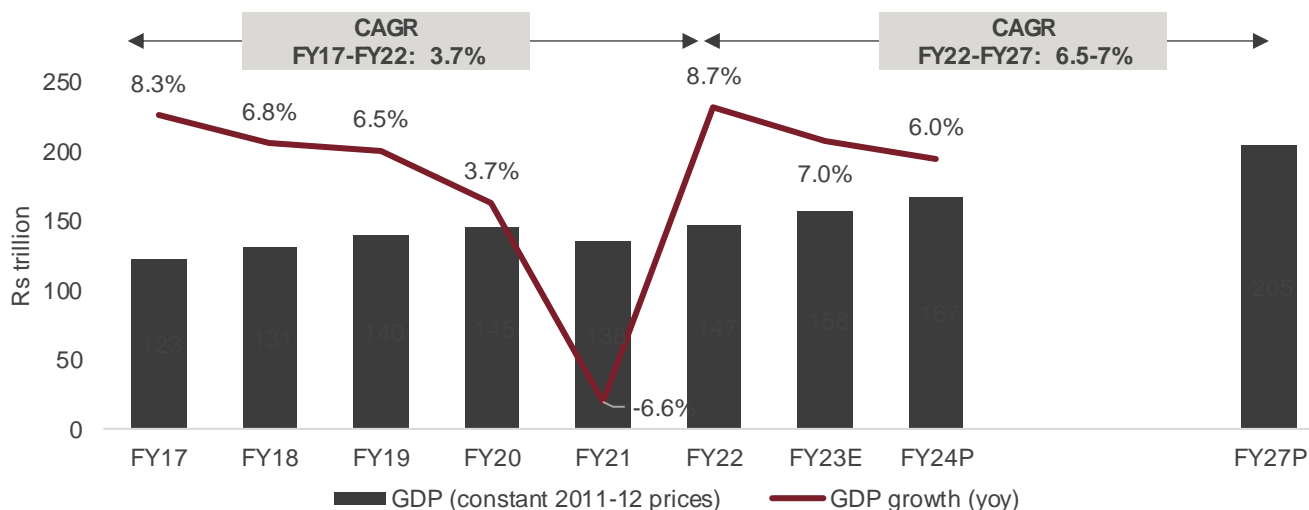


Advanced economies – US, Japan, euro area; Emerging market and developing economies – China, India, Russia, Brazil, Mexico, South Africa
 Note: Volumes of exports of goods and services have been considered for the calculations
 Source: IMF (World Economic Outlook – October 2022 update), CRISIL MI&A

Overview of the Indian economy

Review of real GDP growth over fiscals 2017-2022 and outlook for fiscals 2022-2027

GDP growth pace to slow down to 7.0% in fiscal 2023, long term growth expected at 6.5-7.0% CAGR



P: Projected; E: Estimated, FY22 – Second advance estimate
Source: National Statistical Office (NSO), CRISIL MI&A estimates

India to remain a growth outperformer globally

Despite the markdown in near-term growth, India is expected to remain a growth outperformer over the medium run. We expect India's GDP growth to average 6.6% between fiscals 2024 and 2026, compared with 3.1% globally — as estimated by the IMF.

Drivers for India's economic growth

- Stronger domestic demand is expected to drive India's growth premium over peers in the medium term
- Investment prospects are optimistic, given the government's capex push, progress of Production-Linked Incentive (PLI) scheme, healthier corporate balance sheets, and a well-capitalised banking sector with low non-performing assets (NPAs)
- India is also likely to benefit from its supply-chain derisking strategy as global supply chains get reconfigured with focus shifting from efficiency towards resilience and friend shoring
- Private consumption (~57% of GDP) will play a supportive role in raising GDP growth in the medium term

Factors that will shape growth in fiscals 2023 and 2024

Household demand is holding up this fiscal, helped by services catch-up and government capex: Consumer spending is growing in pockets for some goods and services. Among passenger vehicle sales have been recording double-digit growth since May 2022 as the festive season especially augured well for consumer spending after two pandemic years of subdued celebrations.

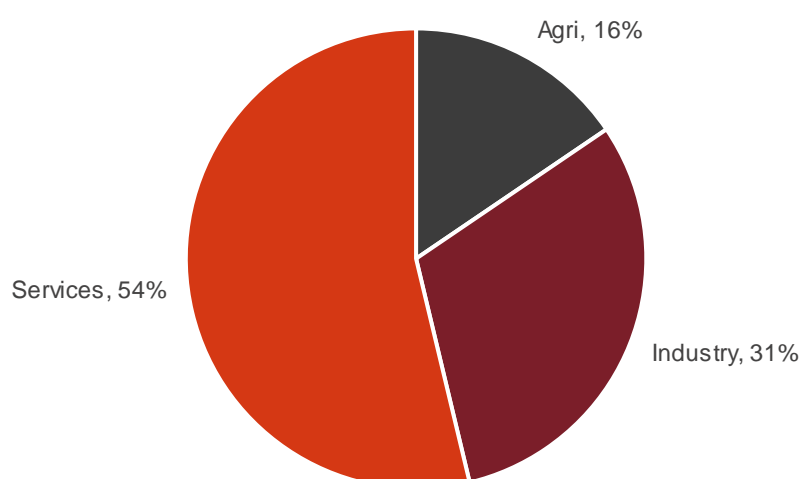
Increased synchronisation of global and domestic growth cycles: Long-term growth movements suggest that despite being on divergent trends, India's growth cycles have been remarkably synchronised with those of advanced economies since the 2000s (see chart below). Put another way, there is no escaping the short-term demand fluctuations around the trend and this

time will be no different. The deceleration of major developed economies underway will create downside risks for India's growth outlook.

Government policies to boost manufacturing in India

India's economic output is mainly driven by the high-productivity services sector which contributes 54% of the economic output. Industry accounts for a distant second at 31%, of which, manufacturing accounted for nearly 60%. Growth in the manufacturing sector can not only increase jobs in the sector but also reduce forex outgo on imported goods. Hence, the government has introduced several incentives in the past decade to boost the manufacturing sector in India.

Sectoral GDP share (FY22)



Source: CRISIL MI&A

Make in India

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

Decoupling of global supply chains

As traditional supply chains are threatened by large scale global events, a rising trend in protectionism and wage inflation, there is a greater need for rethinking supply chain models to remain competitive. In the wake of global disruptions such as Covid, geopolitical crises, environmental disruptions, etc., significant decoupling of supply chains is happening to bring key supply links closer home, particularly the ones situated in China.

To establish collective supply chains that would improve their resilience in the long term, 18 economies, including India, the US and the EU unveiled a roadmap in July 2022 which included steps to counter supply chain dependencies and vulnerabilities. This was done as a part of the ongoing supply chain derisking strategy of global companies/multinationals, wherein global companies are diversifying their businesses away from their reliance on a single large supplier, to alternative destinations. Beijing's Zero-Covid policy and the attendant disruptions to global supply chains, container shortage and higher lead times have served as an impetus to this strategy. This reorientation has benefitted other Asian economies in southeast Asia and India. India can take advantage of the same as the enormous quantum of Chinese exports coupled with India's cost advantage in

Consulting

manufacturing, would serve as a highly lucrative opportunity for Indian manufacturers. Realising this opportunity, the government has introduced many reforms and incentive schemes to increase domestic manufacturing and attract global manufacturing firms to India.

Atmanirbhar Bharat

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

The scheme was launched with the primary intent of fighting the pandemic and making the country self-reliant based on five pillars: economy, infrastructure, technology-driven system, demography, and demand. The stimulus package announced by the government under the scheme consisted of five tranches, intended to boost businesses, including Micro, Small and Medium Enterprises (MSMEs), help the poor (including farmers), boost agriculture, expand the horizons of industrial growth, and bring in governance reforms in the business, health, and education sectors.

The mission emphasises the importance of encouraging local products and aims to reduce import dependence through substitution. It also aims to enhance compliance and quality requirements to meet international standards and gain global market share.

The government has also rolled out other reforms — namely, supply chain reforms for agriculture, rational tax systems, simple and clear laws, capable human resources, and a strong financial system.

Production Linked Incentive (PLI) scheme

The PLI scheme's prime objective is to make manufacturing in India globally competitive by removing sectoral disabilities, creating economies of scale, and ensuring efficiency. It is designed to create a complete component ecosystem in India and make the country an integral part of the global supply chain. Furthermore, the government hopes to reduce India's dependence on raw material imported from China. The scheme is expected to boost economic growth over the medium term and create more employment opportunities, as many of the sectors covered under the scheme are labour-intensive. It will be implemented over fiscals 2022 to 2029.

Construction spends across industrial investments in fiscal 2023 are seen rising 6-10% owing to the high base in fiscal 2022 where the sector grew owing to deferred investments from fiscal 2021 and capex investments from the PLI scheme coming online. The PLI scheme is a time-bound incentive scheme by the Government of India which rewards companies in the 5-15% range of their annual revenue based on the companies meeting pre-decided targets for incremental production and/or exports and capex over a base year. The stronger-than-expected pick-up in demand and larger companies gaining share from smaller companies has also led to revival of capex in fiscal 2022. The rise in this fiscal was on account of the expansion plans under way by India Inc.

Budgeted incentives for each sector under the PLI scheme

Sector	Segment	Budgeted (Rs bn)*	
Automobile	Advance chemistry cell (ACC) battery	181	751.4
	Automobiles and auto components	570.4	
Electronics	Mobile manufacturing and specified electronic components	409.5	545.15
	Electronic/technology products/IT hardware	73.25	
	White goods (ACE and LED)	62.4	
Pharma and medical equipment	Critical key starting materials/drug intermediaries and active pharmaceutical ingredients	69.4	253.6
	Manufacturing of medical devices	34.2	
	Pharmaceutical drugs	150	
Telecom	Telecom and networking products	122	122

Sector	Segment	Budgeted (Rs bn)*	
Food	Food products	109	109
Textile	Textile products: man-made fibre (MMF) and technical textiles	106.8	106.8
Steel	Speciality steel	63.2	63.2
Energy	High-efficiency solar PV modules	240	240
Aviation	Drones and drone components	1.2	1.2
Total			2,192

*Approved financial outlay over a five-year period

ACE: Appliance and consumer electronics; LED: Light-emitting diode

Source: Government websites, CRISIL MI&A

Review of and outlook on the automotive industry (fiscals 2017-2027P)

The two-wheelers segment dominates the Indian auto industry (~77% by volumes) and primarily dictates its tone. The industry saw a decline of 4.8% CAGR (during fiscals 2017 to 2022) in total two-wheeler sales along with a flat CAGR in the passenger vehicles and commercial vehicles segments. A decline of 12% in three-wheelers was observed. Across segments, there was a decline owing to a slowdown in the economy, transition to BS VI norms, and the challenges posed by the pandemic. In fiscal 2022, the two-wheeler industry recorded a de-growth of 9.5% whereas three-wheelers, passenger vehicles and commercial vehicles grew by 18.9%, 24.8% and 26.2%, respectively. EVs are gaining in India and are growing faster than ICE vehicles across the 2W, 3W and 4W sectors.

Growing population and urbanization provide for opportunities in the automotive sector, as they call for increasingly fast, safe, and reliable transportation modes. Electrification and other energy and eco-friendly solutions result from growing energy demand that is coupled with growing public awareness of energy efficiency and increasing public policies on energy, such as stricter emission laws. EVs hold a high potential for emission-efficient mobility solutions across the world, including two-wheelers, three-wheelers and passenger vehicles supported by government incentives for setting up EV charging infrastructure and vehicle purchase subsidies which have helped in increasing demand for EV's and reducing battery prices due to increase in production capacities across the world. The automotive industry is subject to seasonality throughout the year, as it has been seen in that past that during festive periods the sales generally see an uptick while in periods of low economic activity such as monsoon or during plant shutdowns the sales/offtake generally sees a downturn.

Automobile segments (domestic sales volumes)

Automobile segments	Sales volume, FY22 (million units)	CAGR% FY17-FY22	FY23E (y-o-y growth %)	Sales volume, FY27P (million units)	CAGR% FY22-FY27P
Commercial vehicles	0.72	0%	31-33%	1.27	11-13%
Passenger vehicles	3.07	0%	24-26%	5.17	10-12%
Two-wheelers	13.73	(4.8)%	13-15%	22.43	9-11%
Three-wheelers	0.27	(12.1)%	51-53%	0.58	17-19%

Source: SIAM-Society of Indian Automobile Manufacturers, CRISIL MI&A

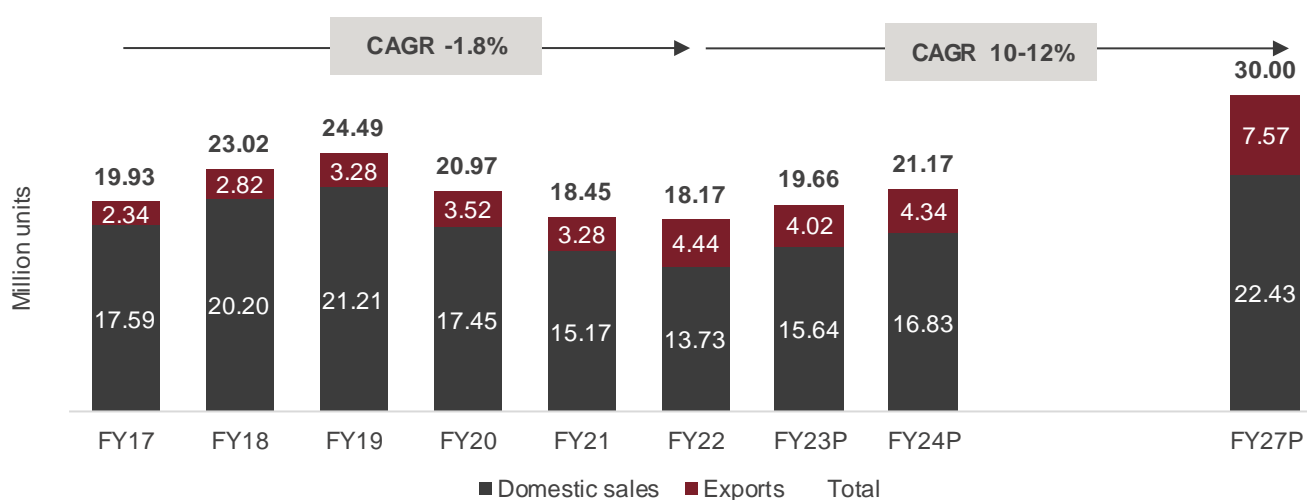
Review of and outlook on the two-wheeler industry (fiscals 2017-2027P)

India is the largest motorized two-wheeler market in the world, with domestic sales of 13.73 million units in fiscal 2022. It constitutes ~77% of the total market comprising two-wheelers, three-wheelers, PVs and CVs by volume; and ~13% in value terms (~Rs 642 billion). Furthermore, India is also one of the largest exporters of two-wheelers in the world.

The Indian two-wheeler production grew at a CAGR of -1.8% between fiscals 2017 and 2022, because of lower output in fiscal 2020, owing to the transition to BS-VI norms and the Covid-19 pandemic-triggered challenges in fiscal 2021. However, during fiscals 2016-19, the industry posted 9% CAGR thanks to good monsoon, favorable economic situation, and rising exports.

Two-wheeler demand in India declined at a meagre 2% CAGR between fiscals 2016 and 2021, after seeing consecutive double-digit decline of 18% and 13% in fiscals 2020 and 2021, respectively. However, exports clocked 5% CAGR over the same period.

Two-wheeler production volume



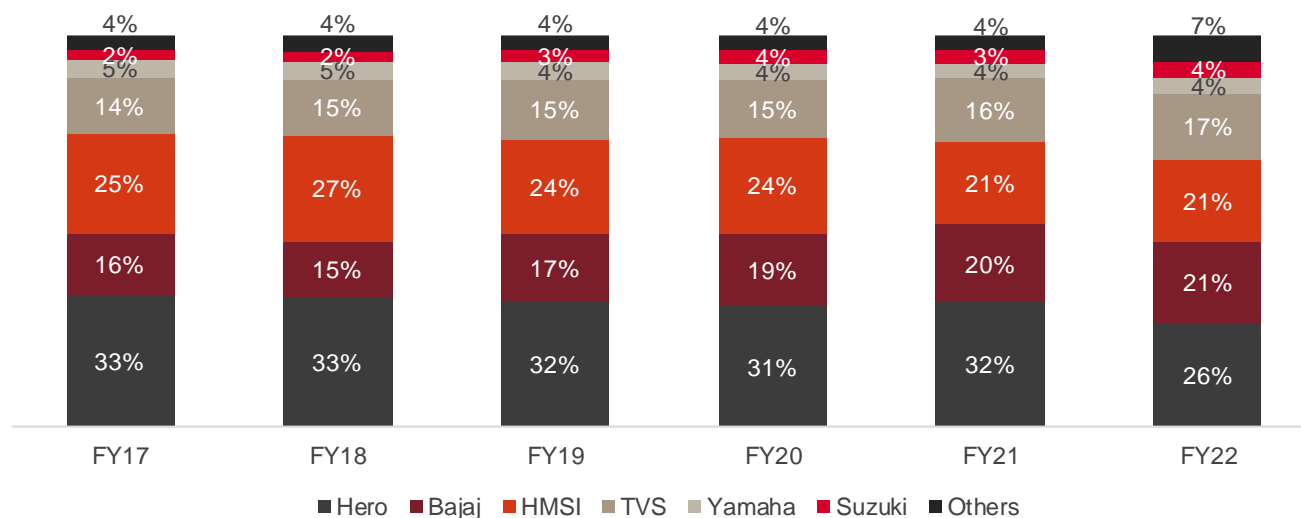
Source: SIAM, CRISIL MI&A

CRISIL MI&A expects two-wheeler exports from India to log a CAGR of 10-12% between fiscals 2022 and 2027, compared with 13.7% between fiscals 2017 and 2022. While expansion in geographical reach and extensive product portfolios will drive growth, crude oil prices and currency fluctuations in export markets remain key monitorables. Revival in the African economy is expected to lift exports in the long term. Moreover, government initiatives to make India an exports hub, along with policies such as Production-linked Incentive (PLI), provide further impetus to two-wheeler exports.

Production split by OEMs

Competition in the two-wheeler industry has intensified across all segments over the past few years owing to capacity additions, expansion of dealership network, and model launches at competitive price points. OEMs such as Honda, TVS and Royal Enfield have been steadily gaining market share, heightening competitive intensity over the past few years. The trend is expected to continue, with the premium motorbikes and 125 cc scooters tipped to witness most of the action in the next few years.

Production split by OEMs



Note: Share of production is shown for OEM's which are part of SIAM

Source: SIAM, CRISIL MI&A

Domestic sales vis-à-vis exports

Domestic sales accounted for ~86% of the Indian two-wheeler industry over the past five years, though manufacturers such as TVS Motor Company, Bajaj and HMSI have been expanding their geographical footprint. Also, joint ventures with global brands—such as KTM, Husqvarna and BMW—and catering to the global demand of these brands from India have given an additional thrust to two-wheeler exports.

Growth drivers for domestic sales

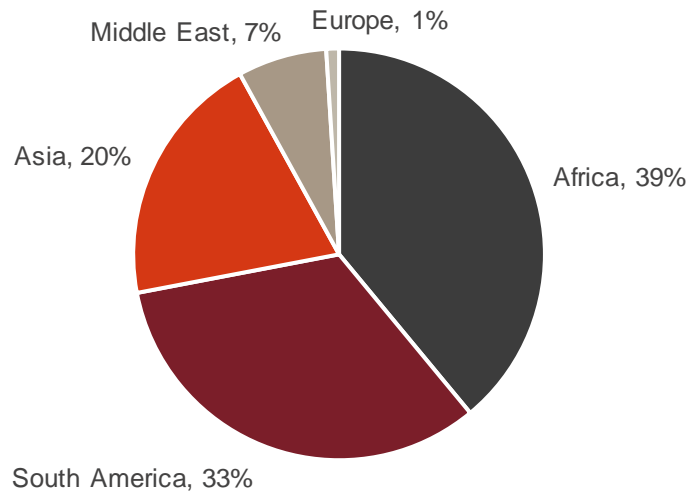
- The main driver is likely **improvement in macroeconomic factors** following subdued growth earlier this fiscal. CRISIL MI&A expects GDP to clock 6.5-7.0% CAGR between fiscals 2022 and 2027. Inflation, on the other hand, is expected to remain soft to moderate. Higher GDP growth and lower inflation would boost domestic sales, led by better affordability with a rise in disposable income
- Higher penetration in semi-urban and rural markets will steer growth in two-wheeler sales
- Finance penetration is likely to rise in the long term, with continued focus of banks and NBFCs on semi-rural and rural areas
- Rural infrastructure growth has a pronounced impact on rural incomes, in turn, boosting domestic sales. Strong investments under infrastructure schemes will further boost rural infrastructure, with a multiplier effect. Farm income is also expected to grow moderately going forward, with improvement in irrigation facilities, increase in mechanisation and crop yields, and continued government support
- The use of two-wheelers (mainly electric) in last-mile delivery by e-commerce players/food chains would also drive demand for it

Region-wise exports

Indian two-wheelers are exported to crude oil exporting developing countries, primarily in Africa and Latin America, which collectively constituted ~55% of India's exports in fiscal 2022. Hence, crude oil prices and currency fluctuations have an impact on India's two-wheeler exports. Exports jumped 36% in fiscal 2022, on a low base of fiscal 2021, driven by improved economic

sentiment, uptick in mobility, monetary easing, and improved production. There was a price hike each in July and October 2021, driven by commodity prices. OEMs' efforts to diversify into more promising geographies boosted exports in fiscal 2022.

Share of key export destinations (YTD fiscal 2023, April-November)

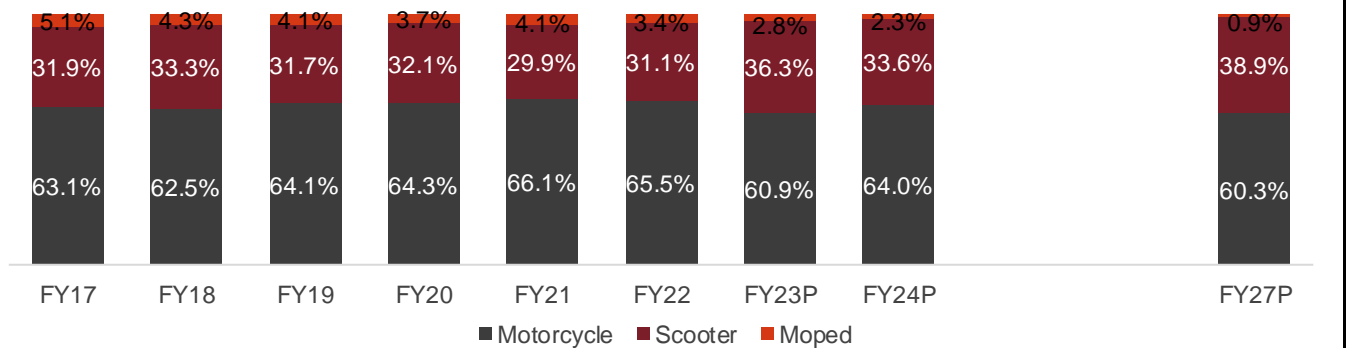


Source: Directorate General of Foreign Trade (DGFT), CRISIL MI&A

Split by motorcycle, scooter, and moped sales

Motorcycles dominate the domestic two-wheeler space, with ~65% market share in fiscal 2022, but domestic demand for motorcycles declined 10% on-year due to weak rural demand. CRISIL MI&A expects motorcycle demand to increase 5-7% on-year this fiscal.

Segment-wise domestic two-wheeler share



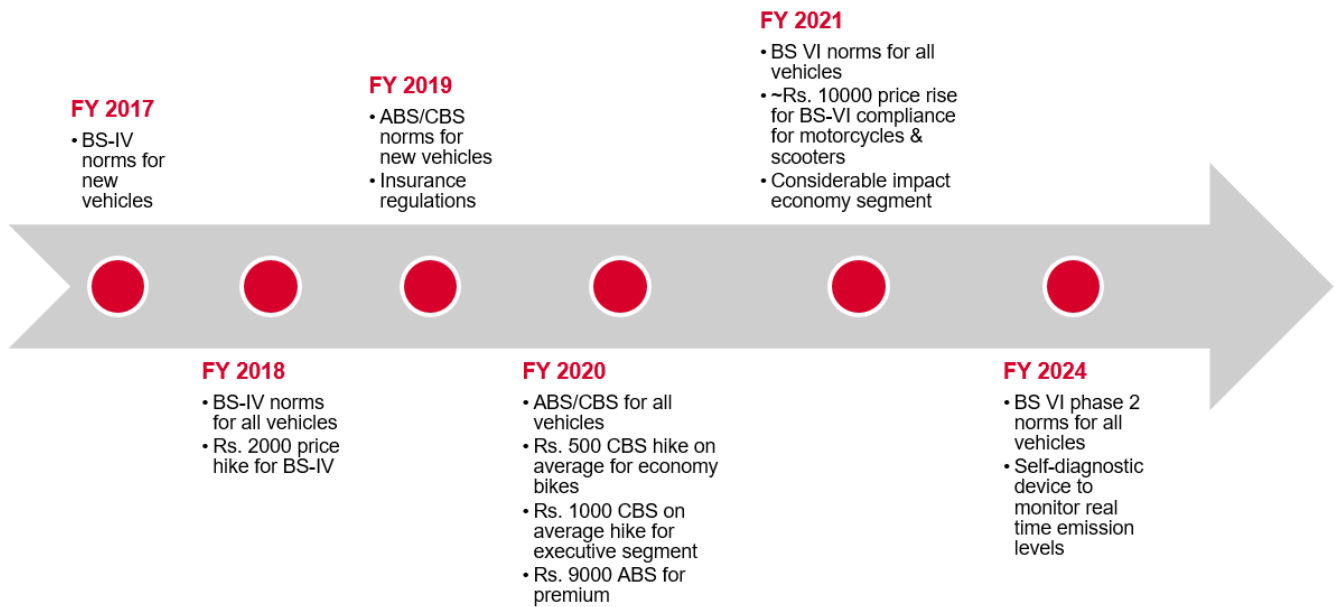
E: Expected

Source: SIAM, SMEV, CRISIL MI&A

Key domestic regulations

The Indian government has been taking aggressive steps to converge emission standards with global norms. In February 2016, it decided to skip BS-V norms and directly mandate BS-VI norms. Compliance with the latest emission standards requires improvement mostly in the exhaust system, thereby increasing the prices of two-wheelers.

Regulatory timeline and its impact on prices

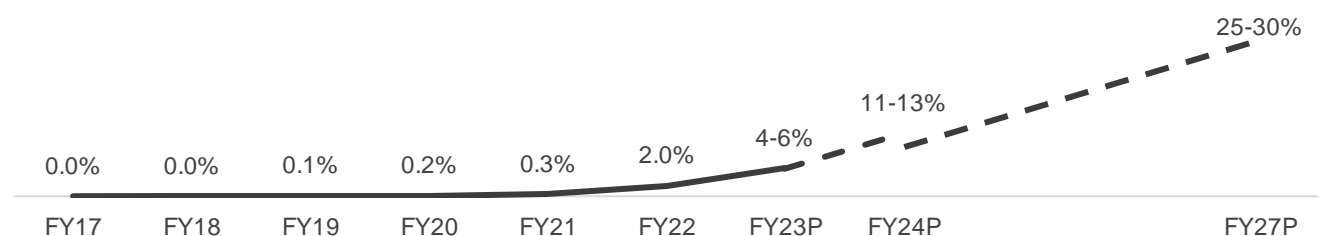


Source: Industry, CRISIL MI&A

Key macroeconomic drivers for domestic sales

- **Macroeconomic scenario:** The performance of the Indian 2W automotive sector is dependent on numerous social and economic factors, including demographic trends and preferences, employment and income levels, affordability of 2W vehicle customers, changes in government policies, economic conditions, availability of finance and interest rates
- **Investment in infrastructure:** Rural infrastructure also has a pronounced impact on rural incomes and, in turn, two-wheeler sales. Firstly, by generating employment in the rural economy during the construction of roads, thereby acting as a wage and income multiplier. secondly, by enabling mobility and accessibility
- **Finance availability:** Stringent credit norms and credit information through the Credit Information Bureau (India) Ltd (CIBIL) have helped players widen their customer base. Moreover, the entry of NBFCs targeting markets exited by banks, and captive NBFCs (operated by two-wheeler manufacturers) largely focusing on non-metros have raised competition in the industry
- **Women participation:** More women in the workforce (a sharp rise in the past decade) has increased the overall household income, boosting two-wheeler sales. CRISIL MI&A estimates 35-40% of typical urban two-wheeler sales are due to women participation.

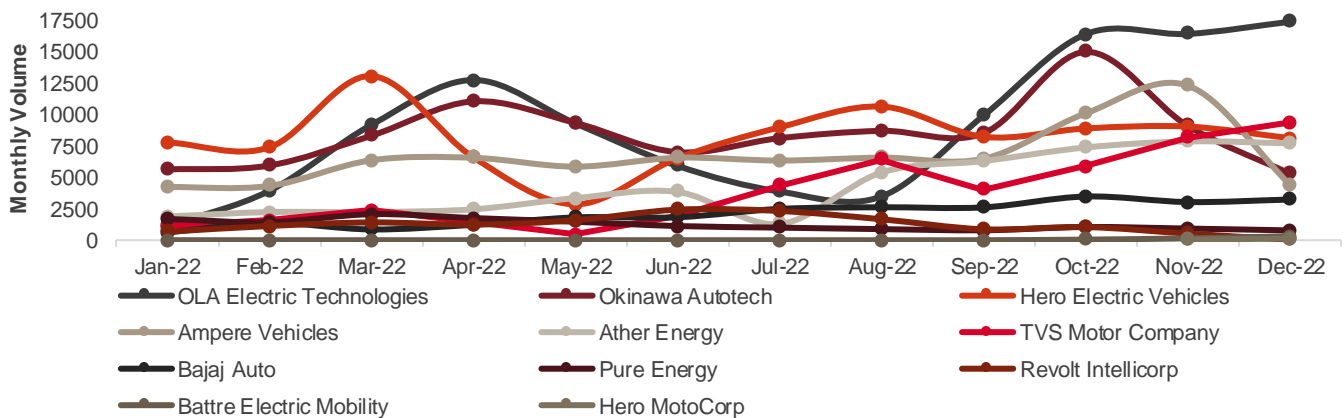
Electric vehicle penetration



Source: SIAM, SMEV, VAHAN, CRISIL MI&A

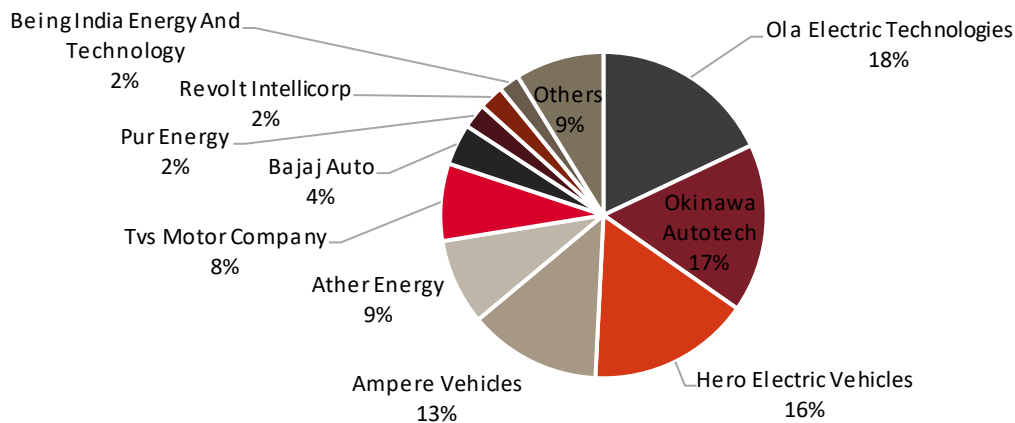
In order to curb pollution levels, EVs are gaining global interest. In India as well, EVs are gaining popularity as the government is extending support via Faster Adoption and Manufacturing of Hybrid and Electric (FAME) II vehicles and tax rate cuts in order to encourage EV adoption. Furthermore, growing awareness and concern for environmental issues is likely to drive electrification in India. We expect e-2W market penetration to be 4-6% by fiscal 2023, and we expect e-2Ws to start contributing meaningfully from fiscal 2024 and reach 25-30% penetration by fiscal 2027 growing at a CAGR of 84% to 86% between fiscals 2022 and 2027.

Monthly retail sales of e-2W in 2022



Source: VAHAN, CRISIL MI&A

Market Share for e-2W in CY2022



Source: VAHAN, CRISIL MI&A

In fiscal 2022, e-2W sales totaled 0.32 million units vs 0.14 million units in fiscal 2021 (124% growth on-year). e-2W sales jumped last fiscal due to improved model availability, new model launches by ICE OEMs, lower priced models, improved charging infrastructure availability, hike in FAME subsidy from 10k/kWh to 15k/kWh, and TCO parity with ICE vehicles. Sales of high-speed e-2W totaled 0.27 million units in the first half of 2023, similar to sales in the previous fiscal. The industry is currently driven by supply and capacity of the OEMs with ample demand. Non-legacy players like Ola Electric, Okinawa Scooters, Ather Energy, Ampere EV by Greaves, etc are gaining a strong foothold in the domestic e-2W industry, stealing a march on the established OEMs, and are disrupting the market with a hope to leverage their first-mover advantage and technological advances. The current e-2W market growth is largely supply driven as high demand for e-2W is not being met by existing suppliers resulting in long waiting periods for e-2W's. The incumbent ICE players have taken longer to enter the e-2W segment, however, they are making up for lost time by rapidly expanding their sales network as well as production capacity and are likely to challenge the top EV players.

Measures enabling home charging, battery swapping, etc. will alleviate range anxiety (fear of running out of charge in the middle of the journey) which is a key concern for EV buyers due to low availability of public charging infrastructure. To address this, and to generate an ecosystem to accelerate EV sales, the Ministry of Road Transport and Highways has decided to set up new EV charging stations. The government has also come up with draft guidelines on battery swapping policy which allows interoperability of batteries which is a positive for battery swapping stations which can be setup at petrol pumps to address range anxiety for EV owners. However, availability of necessary infrastructure, especially the provision for DC fast charging in remote petrol pumps (away from cities), remains a monitorable.

As per our analysis, bulk of the migration towards EVs will take place from the scooter segment. The scooter segment contributed ~30% of two-wheeler sales in fiscal 2022 and 32% in the first half of 2023 and has a higher urban penetration of 65-75% compared with motorcycles, which is largely rural demand driven. EV adoption in the two-wheeler segment will be largely driven by urban scooter buyers by fiscal 2027, because the cost of ownership in case of electric scooters will be less than that for ICE scooters. Major OEMs are already in the process of developing EVs in-house or acquiring stake in the existing EV start-ups in order to diversify their offerings.

Since EVs are simpler to produce than traditional ICE vehicles, many new OEMs have emerged, both start-ups (such as Ather Energy, Simple Energy, Tork Motors that have developed EV offering indigenously) as well as established business houses such as JSW group foraying into EV manufacturing.

Key trends and growth drivers

- Government intervention in regulations and policies
- Total cost of ownership (TCO)
- Growing awareness regarding environmental issues

Government intervention in regulations and policies

The Government of India, through various ministries, has formulated policies for the development of the EV sector in India. The Ministry of Power has revised guidelines for the distribution and sale of power. The following table lists some of the policies and their expected outcomes:

Policy	Policy details	Actual/expected outcome
Reduction in the GST rate for EVs and chargers	<ul style="list-style-type: none"> • From 12% to 5% for EVs, and 18% to 5% for chargers, effective from August 1, 2019 	<ul style="list-style-type: none"> • EV acquisition cost came down. Fast-charging infrastructure cost also reduced
Union Budget 2019-20	<ul style="list-style-type: none"> • Income tax deduction of Rs. 0.15 million on EV loans 	<ul style="list-style-type: none"> • TCO declined, especially for salaried professionals
Warranty condition for eligibility of vehicle under FAME II (May 15, 2019)	<ul style="list-style-type: none"> • Warranty condition revised to three years subject to 20,000 km; earlier warranty on vehicles was provided for one year only 	<ul style="list-style-type: none"> • Customer perception of low quality of EVs expected to change
FAME II subsidy (March 22, 2019) valid till FY24	<ul style="list-style-type: none"> • One million e-2W to be given subsidy at Rs. 10,000 per kwh or 20% of ex-factory price (limited to Rs. 0.15 million) 	<ul style="list-style-type: none"> • e-2W acquisition cost came down, with subsidy up to 20% of ex-factory price for current models
State EV policies	<ul style="list-style-type: none"> • Eight states have finalised their EV policies and eight others have draft policies 	<ul style="list-style-type: none"> • Maharashtra and Delhi are offering incentives, further lowering acquisition cost

Policy	Policy details	Actual/expected outcome
	<ul style="list-style-type: none"> Policy entails supply and demand-side incentives 	<ul style="list-style-type: none"> Demand-side incentives include reduced tariff for EV charging, rebates on road tax, interest-free loans for auto component manufacturers, and non-fiscal incentives for skill development Supply-side incentives include interest subvention on investments made and stamp duty exemption
PMP norms (April 29, 2019)	<ul style="list-style-type: none"> Increase in import duty on EV auto component parts from 10% to 15% from April 2021 	<ul style="list-style-type: none"> OEMs not meeting localisation norms will not be eligible for the demand incentives Subsidies of those EV OEMs who hadn't met the domestic value addition (DVA) criteria were put on hold by the centre in September 2022 The cost of importing parts is also set to increase from April 2021, if a sustainable and cost-effective domestic alternative is not found This will increase acquisition cost of e-2W Our recent interactions with e-2W OEMs suggest vehicle control units, battery packs, and lithium-ion cells are still being considered for substitution
EV charging ecosystem	<ul style="list-style-type: none"> Sixteen state policies in final and draft stages offer incentives for setting up charging stations As per the Ministry of Power's notification issued on December 14, 2018, resale or commercial activity in electricity has been allowed for utilities/service providers providing public charging infrastructure Oil marketing companies' (OMCs) retail pumps will be given priority for installation of public EV charging stations Nine cities with a population of 4 million and above are the focus of phase I of the EV charging policy There must be at least one charging station in a grid of 3 km x 3 km in cities 	<ul style="list-style-type: none"> Under FAME I, the government sanctioned 520 chargers Under FAME II, the government sanctioned 2,636 charging stations across 62 cities Fast and accessible charging will help reduce range anxiety and drive faster adoption of e-2Ws

Source: SMEV, FAME, DHI, and CRISIL MI&A

Regulators play an important role in driving faster adoption of EVs. The FAME II scheme has an outlay of Rs. 100 billion with a major proportion dedicated to demand incentives. Rs 10 billion is earmarked for the development of charging infrastructure. Demand-side incentives under the FAME scheme are applicable until fiscal 2022, and state EV policies (mostly of five-year tenure) until fiscal 2023. Continuation of policies after fiscal 2023 will play an important role in driving adoption of hybrid and EVs. Execution of the schemes will also be a key factor considering that only Rs. 4.4 billion of the Rs. 8.93 billion allocated to

FAME I has been utilised. All the policies and regulations focus on decreasing the acquisition cost and building capabilities through the PMP scheme and the recently announced Production-Linked Incentive (PLI) scheme.

TCO analysis

TCO for scooters in FY22 for four-year ownership

Annual running	8,000 km	10,000 km	12,000 km
ICE-equivalent 2WEV	31% lower cost than ICE	37% lower cost than ICE	42% lower cost than ICE

TCO for scooters in FY27 for four-year ownership

Annual running	8,000 km	10,000 km	12,000 km
ICE-equivalent 2WEV	33% lower cost than ICE	38% lower cost than ICE	42% lower cost than ICE

Total cost of ownership analysis framework takes into consideration down payment/ initial payment, EMI, fuel cost, maintenance cost and battery replacement cost if any over the ownership period adjusted for the resale value

Source: Industry, CRISIL MI&A

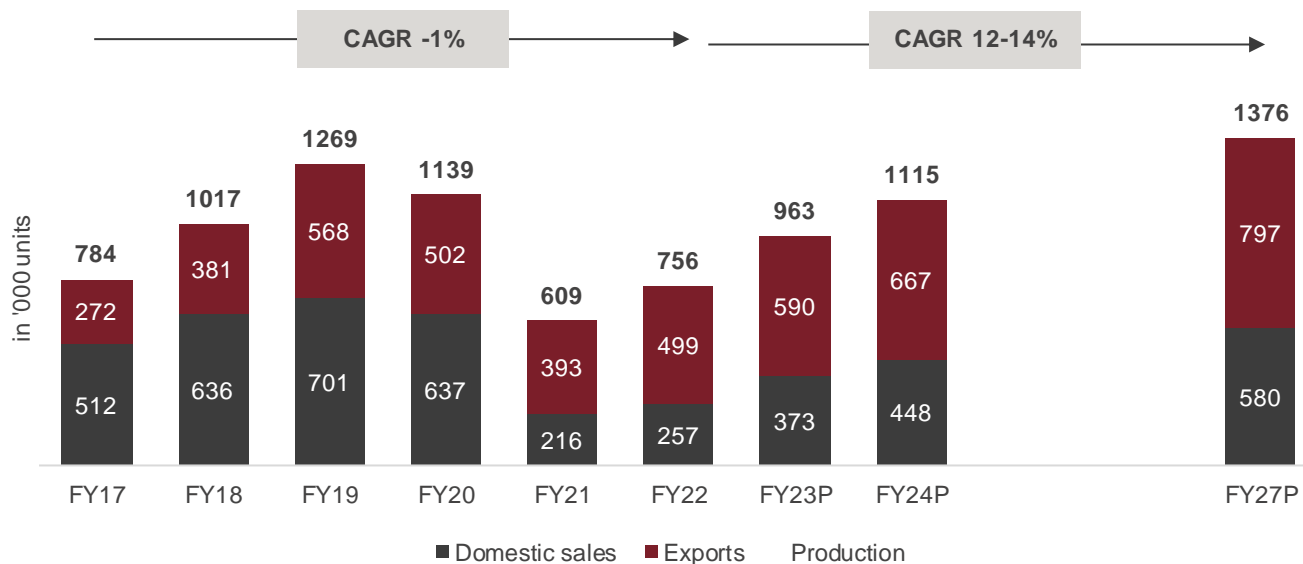
Growing awareness regarding environmental issues

Alarming levels of air pollution among metro cities in India and actions taken by the local governments is resulting in higher awareness levels among masses, especially youth, regarding environmental issues and advantages of EVs in addressing some of these issues. Growing awareness levels and concern regarding environmental issues is therefore likely to be one of the drivers for electrification in India.

Review of and outlook on the Indian three-wheeler industry

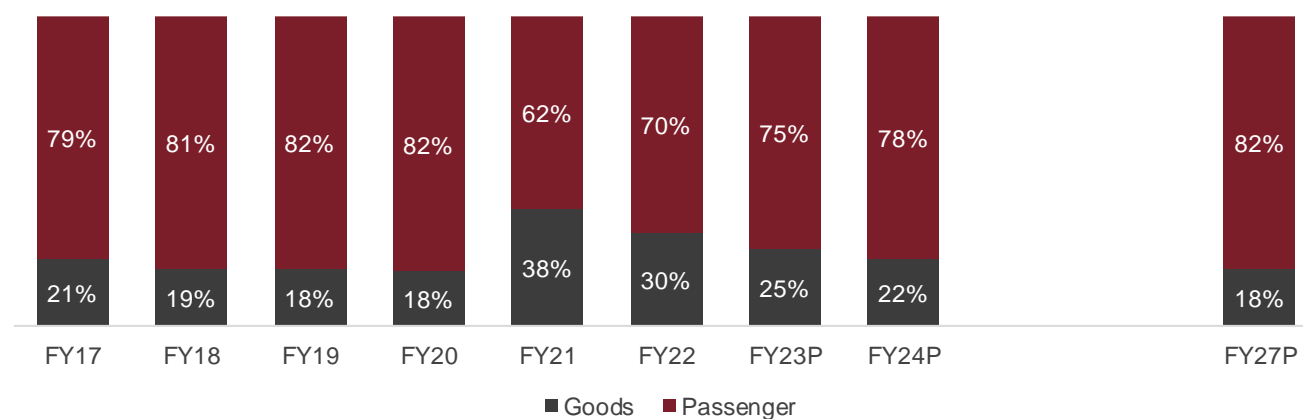
India is the largest three-wheeler (3W) market in the world, with a domestic sale of 0.27 million units in fiscal 2022. It contributed to ~2% of the total market (comprising 2Ws, 3Ws, passenger vehicles/PVs and commercial vehicles/CVs) by volume and ~ 1% by value (~Rs 30 billion).

3W production volume trend



Source: SIAM, CRISIL MI&A

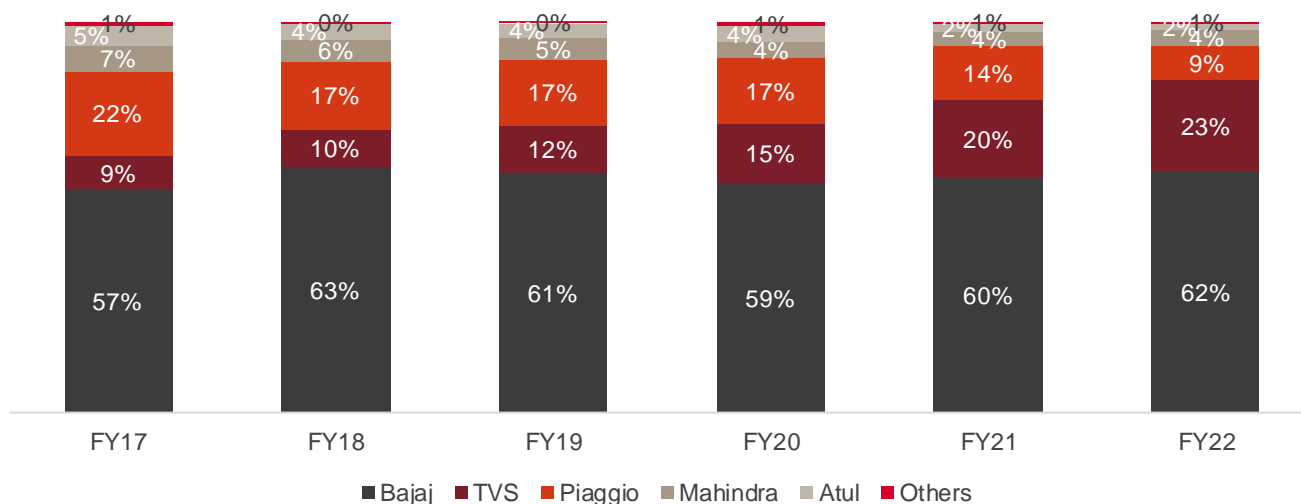
Split into 3W segments by volume



Source: SIAM, CRISIL MI&A

The passenger segment contributed to a majority share of the overall domestic sales of 3Ws and accounted for ~70% in fiscal 2022. It is expected to log 20-22% CAGR between fiscals 2022 and 2027, whereas goods 3Ws are expected to grow 6-8%.

Production split by OEMs

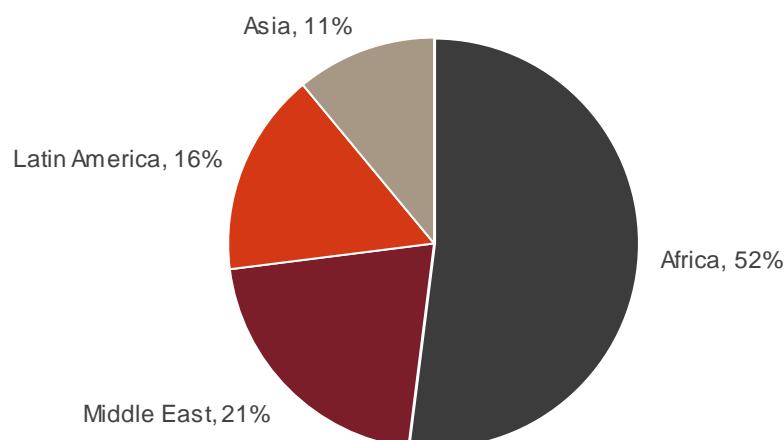


Note: Share of production is shown for OEM's which are part of SIAM

Source: SIAM, CRISIL MI&A

Competition in the 3W industry is reasonably consolidated, with Bajaj at the helm over the past five years. Players such as Bajaj, TVS, Piaggio, Mahindra and Atul make up more than 99% of the market. While Piaggio is dominant the goods segment, Bajaj is way ahead of competition in the passenger segment.

Share of key export destinations (April-November 2022)



Source: Directorate General of Foreign Trade, CRISIL MI&A

Exports to Africa in April-November 2022 (YTD fiscal 2023) amounted to ~Rs 14.8 billion and to Middle East, ~6 billion. Latin America and Asia contributed to the rest, at ~Rs 4.6 billion and Rs 3.2 billion, respectively.

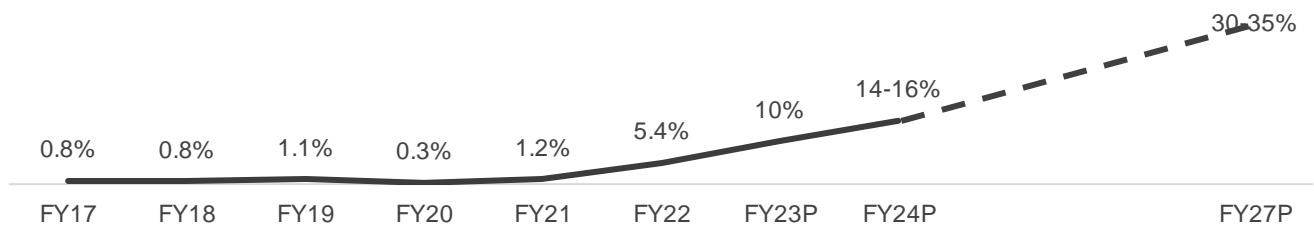
Share of exports to Asia rose amid increased exports to Indonesia. Nigeria extended its lead by 7 percentage points to 35% during April-August 2022 vis-à-vis the same period last year. However, the drop in demand from Egypt restricted exports to Africa, while higher exports to Mexico and Peru supported share expansion of Latin America.

Key trends and growth drivers

- Stable agricultural output
- Fillip to industrial output
- Scrappage policy
- Improvement in shared mobility and rising intra-city movement

E-3W penetration

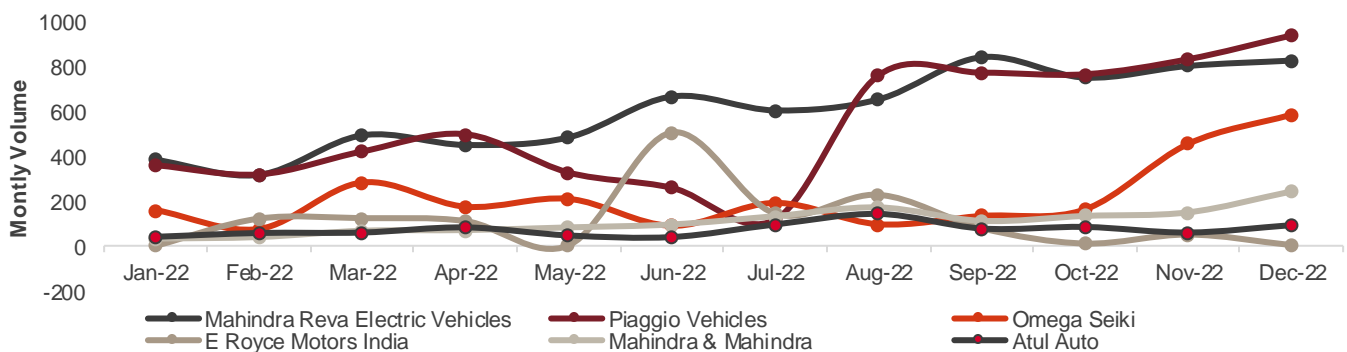
Penetration of e-3Ws



Source: SIAM, SMEV, VAHAN, CRISIL MI&A

Climate change concerns, pollution, and the surge in oil prices have driven the government take policy initiatives to move towards electric mobility. The country is now a signatory to the Paris Agreement and part of the Electric Vehicle Initiative 30@30 campaign. With this, the automotive sector, including the 3W segment, is set to receive substantial policy stimulus. E-rickshaws dominate this space. The key trends and growth drivers for electrification include changes in regulations and policies, total cost of ownership and growing awareness about environmental issues. The Government, through various ministries, has formulated policies, such as the FAME II policy, for the development of the EV sector in India

Monthly retail sales of e-3W in 2022



Note: e-3W do not include e-rickshaws

Source: VAHAN, CRISIL MI&A

Mahindra Reva and Piaggio are the top two players in 2022, together accounting for over 50% of the market in e-3W segment. They have seen strong growth in their sales in 2022 as three-wheeler operators looking to lower their operating costs amid high fuel prices are seen switching to electric variants.

E-3W's use lithium-ion batteries and have a speed more than 25 kmph. They are used for cargo as well as passenger movement. Very few players such as Mahindra Electric and Piaggio are present in this space. Under FAME-I, lead acid battery driven e-3Ws were also eligible for the subsidy. However, under FAME-II, only advanced batteries and registered vehicles are eligible. Higher initial cost of e-autos, lack of availability of wide range of products in the market, and poor charging infrastructure availability have posed challenges to their penetration. which stood at ~5% as of fiscal 2022.

Despite these challenges, lowering operating cost economics and environmental cleanliness of the vehicle have supported the shift towards e-autos. E-3W passenger vehicles, unlike ICE vehicles, do not fall into the ambit of the permit system. This has also led to a shift in customer preference towards e-3Ws. As more players launch products in this category, we expect it to drive 3W sales. Incentives declared in the FAME II and state EV policies are also anticipated to drivers.

Government's FAME policy to promote EVs

Incentive structure under FAME II

Maximum no. of vehicles to be supported	Approx. size of battery in Kwh	Incentive (Rs/ Kwh)	Maximum incentive (Rs)	Max ex factory price to avail incentive (Rs.)	Total fund supported (Rs Cr)
500,000	5	10,000	20% of cost of vehicle	500,000	2500

Source: Department of Heavy Industries (DHI), CRISIL MI&A

FAME II versus FAME I

	FAME II		FAME I	
	Approx. Incentive	Max ex-factory price(Rs lakh)	Incentive L1 (Rs)	Incentive L2 (Rs)
Registered 3W	40,000-62,000	5	45,000	54,000

Source: Department of Heavy Industries (DHI), CRISIL MI&A

Electric penetration is expected to be ~10% in fiscal 2023 aided by various state EV policies recently announced. By fiscal 2027, we expect the penetration of e-3W's to reach ~30-35% from 5% currently. The electric 3W segment is expected to grow at a CAGR of 66% to 68% between calendar years 2022 to 2027.

Under FAME II, subsidy is made available to 0.5 million e-3Ws. However, under this programme, at least 50% localisation is required, with this limit to be increased in a phased manner. Various states have given additional subsidies to drive EV growth. Delhi's EV policy has even declared subsidy on lead acid-based battery-operated 3Ws.

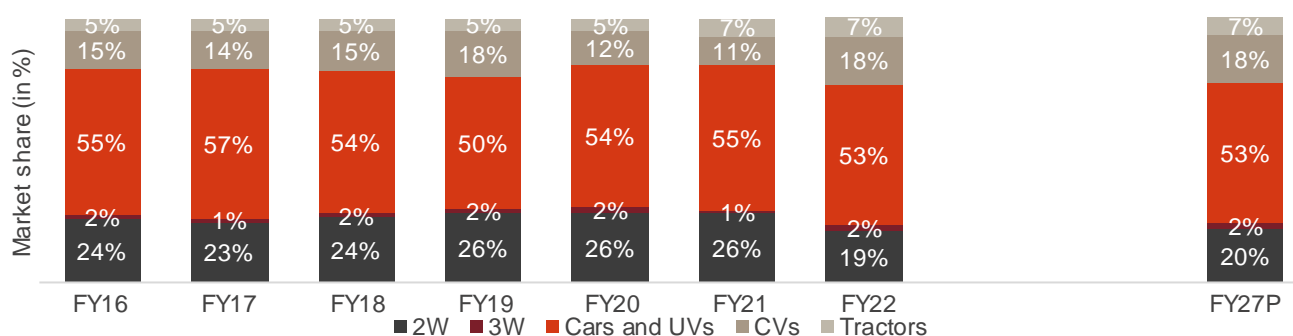
Factors driving growth

- Ban on permits for diesel vehicles by a few top selling 3W states
- Favourable cost economics, strong charging infrastructure, easy availability of finance to drive the growth of e-autos
- E-retail is currently an important segment in e-auto sales. An improving economy amid low to moderate inflation is expected to drive consumer spends in propelling growth in the retail industry, driving sales of e-autos even further
- Strengthening in infrastructure network (metro lines, road connectivity, etc.) and need for zero emission 3Ws for last mile connectivity

Review of and outlook on the Indian auto components industry

OEM auto component industry split by vehicle categories

Auto component production split by vehicle categories



E: Expected

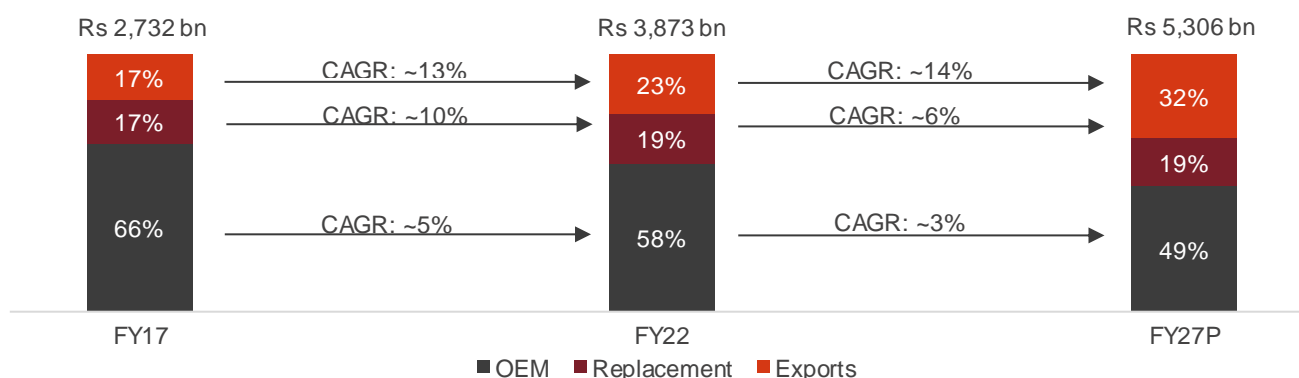
Source: CRISIL MI&A

Demand for auto components from OEM segments is expected to grow 28-30% in fiscal 2023. Overall, realisation on components is expected to have increased on account of vehicle price hikes due to the BS-VI transition. Also, the basic raw material index (BRMI), surged by ~10% in fiscal 2021 on account of rise in prices of commodities from Q2 onwards. In fiscal 2022, BRMI surged by ~36-38% in fiscal 2022 and prices of major raw materials such as steel and plastics increased by ~49-53%, that of pig iron by 36-40% and rubber by ~21-25% on year. Thus, the automotive components industry has experienced a price volatility with respect to raw material prices in the fiscal 2021 and fiscal 2022.

Auto component industry by OEM, export, and aftermarket in value terms

Auto component production (which includes sales to OEMs, exports, and the replacement market) has increased at a CAGR of ~7% to Rs 3,873 billion over fiscals 2017-22 from Rs 2,732 billion compared with a negative growth in production across vehicle segments. While domestic sales are more volatile due to various factors like regulations, fuel prices, economic cycles, etc. that impact the short-term demand, exports and aftermarket help buffer the overall auto-component production growth from similar fluctuations.

Auto component production split by OEMs, aftermarket, and exports



Source: CRISIL MI&A

CRISIL MI&A expects the auto component market size to grow at a 5-7% CAGR between fiscals 2022 and 2027, comparable to the 7% CAGR observed over fiscal 2017 to fiscal 2022.

OEM demand: It is expected to grow at a 2-4% CAGR between fiscals 2022 and 2027 on the back of robust production growth across asset classes in the medium term (on a low base) and aided by realisation growth via OEM price increases. Outsourcing in the commercial vehicle segment is lower than for cars but is expected to increase owing to growing technological spends by auto component players due to BS VI and safety norms.

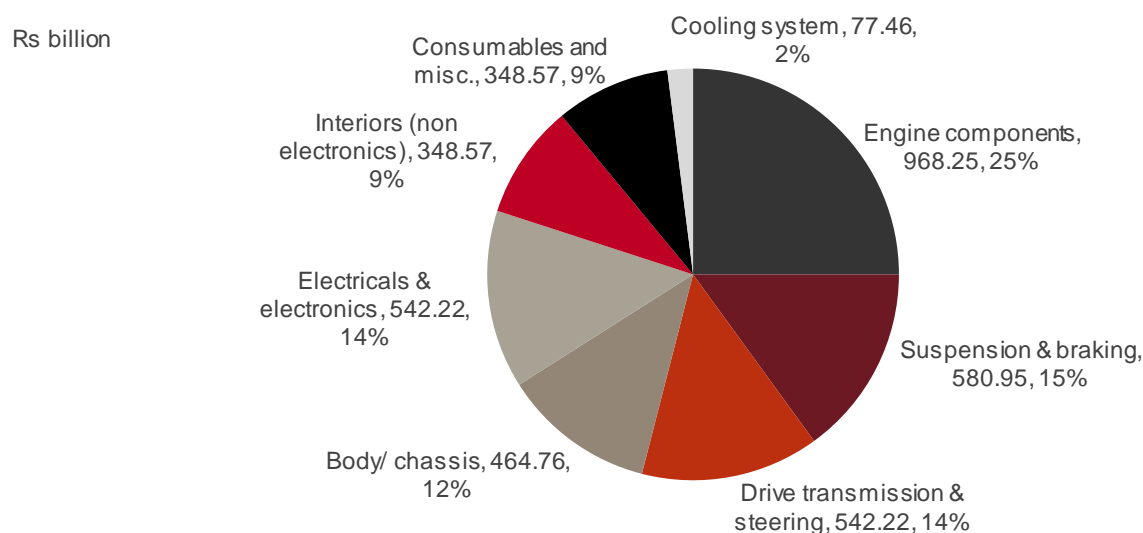
Replacement market: The auto component replacement market is projected to grow at a 5-7% CAGR between fiscal 2022 and 2027 due to increased OEM demand between fiscals 2017 and 2019, along with a replacement cycle of two to three years. Moreover, auto component players undertook price hikes in recent months to offset the uptick in commodity prices. Hence, rising realisation, to some extent, coupled with pent-up demand from fiscal 2021 wherein the vehicular movement was restricted, is likely to support demand growth.

Exports: Auto component exports are projected to grow at a 13-15% CAGR between fiscal 2022 and 2027. As India is enhancing quality and safety standards, players are likely to gain an edge in newer geographies such as other low-cost manufacturing countries. The penetration of Indian automotive components in global exports stands lower as on date, indicating considerable scope for domestic manufacturers to expand their export share in the coming years as they expand into new geographies and widen their product offerings.

In the next five years as well, exports will be primarily driven by the US heavy truck segment, and demand from other key destinations such as Italy, Turkey, and Brazil. The gradual shift of European countries to electric/hybrid cars could offer a huge opportunity for low-cost producing countries (LCCs) such as India in the electric parts segment.

Split by major auto component categories in value terms

Segment-wise production break-up in fiscal 2022



Source: Automotive Component Manufacturers Association (ACMA), CRISIL MI&A

The Indian auto component industry can be broadly classified into organised and unorganised sectors.

The organised sector caters to the demand for high-value precision instruments such as engine parts, and the unorganised sector to the aftermarket with low-value products such as switches.

Over the years, the industry has developed the capability to manufacture the entire range of auto components required for vehicle engine parts, which constitute 25% of production, mainly comprising pistons, engine valves, carburetors, fuel injection systems, camshafts, and crankshafts.

Suspension & braking: The segment includes components such as brakes, brake linings, leaf springs, and shock absorbers, which account for ~15% of the domestic auto component market. Brakes are one of the critical components in a vehicle. Increased focus of the government on vehicle safety has led to regulations making ABS and CBS mandatory across vehicle categories such as two-wheelers, passenger vehicles and commercial vehicles.

Drive transmission & steering: Drive transmission parts, which constitute 14% of total production, include axle assembly, steering parts, and clutch assembly. The steering system industry is technology- and capital-intensive, which act as an entry barrier, especially for smaller players and the unorganised segment

Body and chassis: The segment is fragmented and dominated by the unorganised sector since it is not technology- or capital-intensive.

Electricals & electronics: It is one of the most dynamic segments because of constant evolution of technology. New cars have an increasingly higher proportion of electrical parts.

Exhaust management and cooling systems form the rest of the pie. The exhaust management system has gained more prominence due to stringent emission norms such as BS-VI.

Various automotive components produced by the Indian automotive components industry

Engine & engine parts	Suspension & braking parts	Drive transmission & steering parts	Body and chassis	Electrical & electronics parts	Interiors (non-electronics)	Exhaust management and cooling systems
Piston and piston parts	Suspension parts	Steering system	Sheet metal parts	Starter motors	Seating system	Exhaust pipes
Fuel injection equipment and carburetors	Braking parts	Axle assembly	Fuel tanks	Generators	Mirrors	Mufflers
Powertrain components (cylinder heads, cylinder blocks)		Clutch assembly	Plastic-moulded components	Alternators	Plastic-moulded components	Catalytic converters
Engine cooling systems		Wheel and wheel rims	Rubber components	Flywheels	Rubber components	Radiators
Other powertrain components			Locks	Magnetos		Cooling fans
Engine bearings and valves			Ball and roller bearings	Distributors and regulators		
Exhaust systems						
Gaskets, liners, and filters						
Other engine parts						

Source: CRISIL MI&A

Future growth drivers

Demand-side factors

- Vehicle production across segments is likely to recover, supported by customer preference for personal mobility due to social distancing, vaccine availability, government focus on capital expenditure, and the resultant pickup in the economy
- CRISIL MI&A expects almost all vehicle segments to log robust production growth over fiscals 2022-27. Production of 2Ws, 3Ws, PVs and CVs are projected to grow at a CAGR of 10-12%, 12-14%, 10-12% and 11-13%, respectively, over the forecast period
- Key macroeconomic trends are also likely to support demand for 2Ws, 3Ws, and PVs over the medium to long term. CRISIL MI&A expects urbanisation to reach 37-38% by fiscal 2027 from ~35% in 2020. India's per capita income is also projected to log a 6-7% CAGR over fiscals 2022-27. These factors are likely to drive premiumisation across vehicle segments
- As of fiscal 2020, India's population is among the youngest in the world, with a median age of 28 years. About 90% of Indians will be below the age of 60 by 2020. CRISIL MI&A forecasts that ~64% of them will be between 15 and 59 years by 2031
- Infrastructure improvements are expected to support automobile demand on account of employment generation, and improved accessibility and mobility

Supply-side factors

- The Indian automobile ancillary sector is transforming itself from a low-volume, highly fragmented sector into a competitive industry, backed by competitive strengths and technological improvements led by investments in research and development
- The Indian automotive industry is characterised by strong competition among increasingly quality-conscious manufacturers. The large highly skilled but low-cost manufacturing base makes partnerships with overseas players attractive. These strengths, coupled with India's well-established strengths in IT/software, make the country an emerging player in this sector
- The industry has been continuously upping its quality standards and developing new products to compete globally. Trade liberalisation in western markets has led to the emergence of Asia as an export hub for Europe, and North and South America over the past decade. With supply-chain realignment, several countries (including India) are likely to emerge as global outsourcing hubs in the coming years
- Many domestic manufacturers have successfully entered into strategic alliances/collaborations, while others are actively testing waters. Many of the world's leading Tier 1 suppliers have set up manufacturing facilities in India, including Bosch, Delphi, Visteon, and Denso. Additionally, some suppliers already meet global technical and quality standards at the Tier 1 level. Some of India's leading OEM suppliers include TACO, Bharat Forge, Sundaram Clayton, and Sundaram Brake Linings
- 2W automakers are introducing new models more frequently ever than before. This will also drive growth of the auto component industry as changes in the process of manufacturing and designing will support the pricing power of component manufacturers

Policy support

Impact of BS-VI emission norms on the 2W and 3W auto component industry

The government proposed BS-VI standards for 2Ws and 3Ws in February 2016, skipping the BS-V stage. The proposed limits apply to new 2W models and all 3W models. These standards align with Euro 5 limits for these vehicles.

Implementation of BS-VI regulations is likely to help the auto component industry in terms of increased average realisation for components supplied.

Production-Linked Incentive scheme

The government has budgeted ~Rs. 2 trillion as incentives for local manufacturing units covering 13 key sectors. These sectors include automobile, pharma, telecom, electronics, food, textiles, steel, and energy. By incentivising production and a desired scale, the scheme aims to spawn a handful of globally competitive large-scale manufacturing units in these sectors.

Furthermore, the government also hopes to reduce India's dependence on raw material imports from China. The scheme is expected to boost economic growth over the medium term and create more employment opportunities as many of these sectors are labour-intensive.

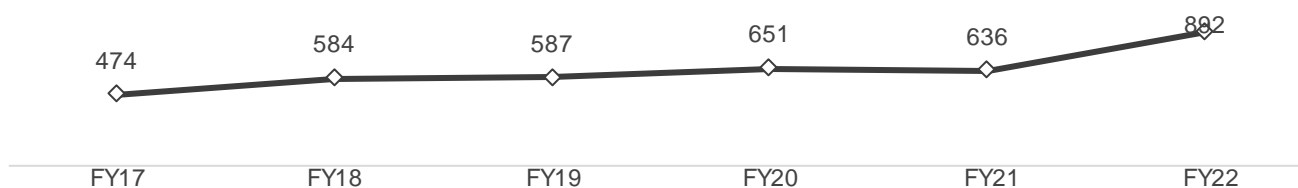
Sector	Segment	Budgeted (Rs billion)*	
Automobile	Advance chemistry cell (ACC) battery	181.00	751.42
	Automobiles and auto components	570.42	

*Approved financial outlay over a 5-year period

Source: Government websites, CRISIL MI&A

Auto component exports by value over fiscals 2017-22

Auto component exports by value (Rs billion) over fiscals 2017-22



E: Expected

Source: Directorate General of Foreign Trade, CRISIL MI&A

India exports auto components mainly to North America and Europe (together account for over 50% of exports). Sales of Class 8 trucks (largest class of trucks) plunged in fiscal 2020 in the US. The EU also faced an economic slowdown and political uncertainty led by Brexit. India even exports to the Asian market, with about 20% of exports targeting these geographies.

In fiscal 2021, exports dropped 2% on-year, as pandemic-led lockdowns led to a decline in vehicle usage and income levels, which lowered the demand for new vehicles. Exports witnessed significant growth in fiscal 2022. Demand from North America and Europe surged by 48% and 37% on-year, respectively, in fiscal 2022 over a low base. Export demand has shown a very strong recovery post easing of pandemic restrictions. However, demand from Europe has been under pressure due to recessionary fears and a global slowdown.

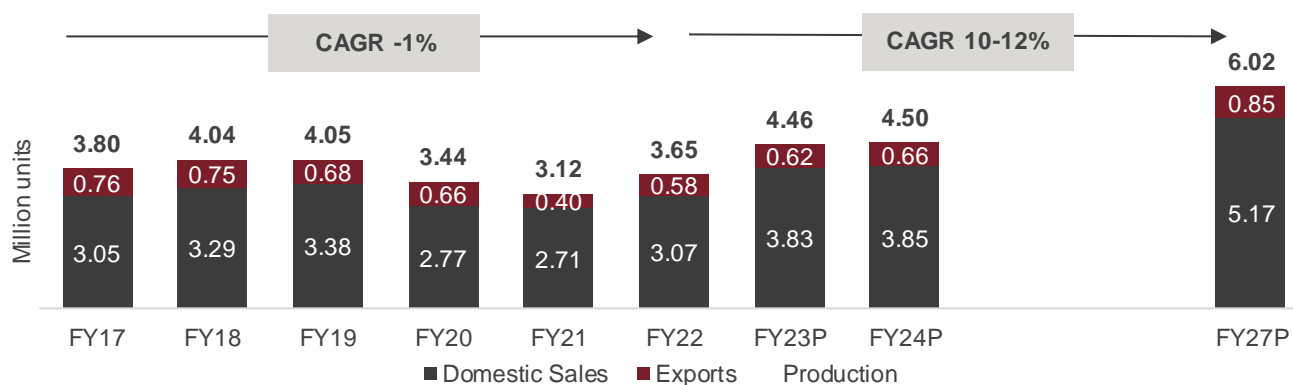
Review of and outlook on the Indian passenger vehicle industry (fiscals 2017-27P)

The Indian passenger vehicle market recorded domestic sales of 3.07 million units in fiscal 2022, accounting for ~17% of the total market of two-wheelers, three-wheelers, passenger vehicles and commercial vehicles by volumes and ~67% in value terms at ~Rs 3.321 trillion.

Production of passenger vehicles (PVs) in India recorded a healthy 5.2% CAGR between fiscals 2016 and 2019 due to a spurt in domestic and export demand. Domestic demand was driven by expansion in the addressable market, development of infrastructure, and the stable cost of vehicle ownership, as crude oil prices remained low except in the few months when output was reduced due to sanctions imposed on Iran.

CRISIL MI&A estimates overall PV production to grow at a 10-12% CAGR from fiscal 2022 to 2027 to ~6 million units by fiscal 2027. After a consecutive drop in production in fiscals 2020 and 2021, PV production is expected to increase at a robust pace over the next five fiscals because of a spurt in domestic as well as export demand.

Review of and outlook on PV production



Source: SIAM - Society of Indian Automobile Manufacturers, CRISIL MI&A

Domestic sales and exports

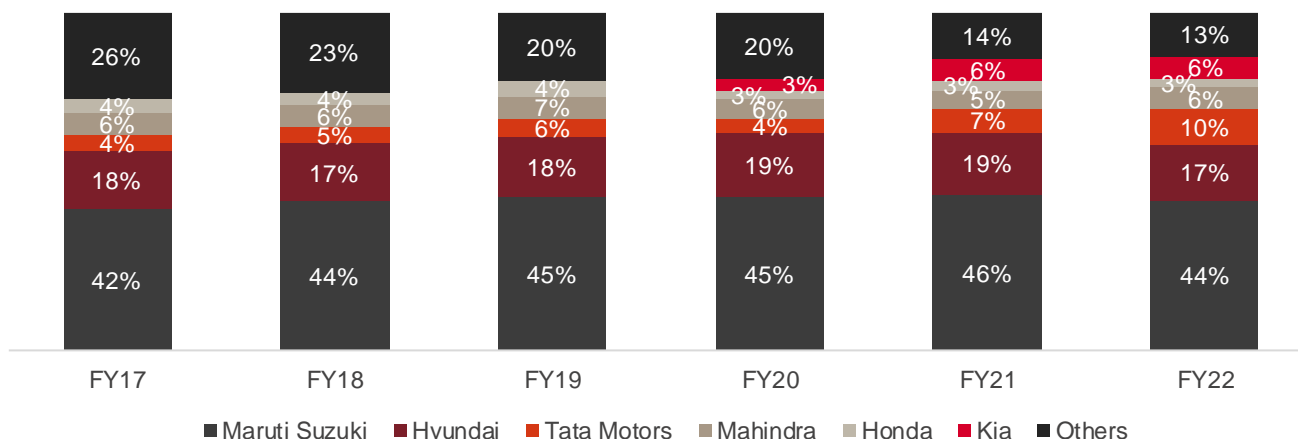
The Indian PV segment focuses on the domestic market, which accounted for over 80% of demand in fiscal 2022. The ratio of exports-to-production for the industry has declined from 20% in fiscal 2017 to 16% in fiscal 2021. This can be attributed to muted exports due to a slowdown in the global automobile industry as well as major OEMs focusing on serving fast-growing domestic markets over foreign markets. In fiscal 2020, this share had gone up to ~20% as OEMs enhanced their focus on export markets. Stagnating domestic traction in the past few years has resulted in foreign automobile manufacturers such as Ford, General Motors (GM), and Volkswagen (VW) increasing their focus on exports, thereby improving utilisation by using spare capacity and boosting revenue. These players are developing India as an export hub, as evident from the consistent increase in the proportion of exports to their total production.

The domestic PV industry grew 6.6% between fiscals 2016 and 2019, led by strong growth in utility vehicles (UVs), which rose 14.9% versus cars, which grew 3.1% during the same period. An improving economic scenario, higher affordability, and new model launches drove demand during this period.

Domestic demand will be driven by an expansion in the addressable market, fast-paced infrastructure development and relatively stable cost of vehicle ownership, as crude oil prices are expected to stabilise at lower levels. The long-term outlook remains bright for exports as efforts to penetrate newer geographies bear fruit and schemes such as PLI incentivise players to tap exports. CRISIL MI&A forecasts exports to grow at a 7-9% CAGR between fiscals 2022 and 2027. Rising

competition in Europe amid sluggish demand growth, however, will limit further growth. Moreover, penetration of electric and hybrid vehicles will be a key monitorable.

Production split by OEMs

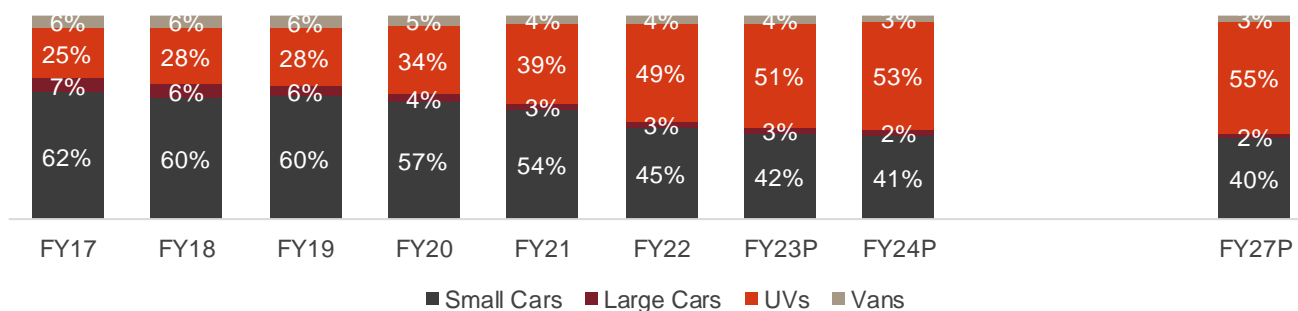


Note: Share of production is shown for OEM's which are part of SIAM
Source: SIAM- Society of Indian Automobile Manufacturers, CRISIL MI&A

Split of industry volume by PV segments

Small cars have a major share in total PV domestic volumes, as their lower ticket size makes them affordable to the average Indian consumer and ideal for first-time car buyers. The UV segment, which traditionally appealed to customers who valued larger seating capacity and ability to drive on rough rural roads, witnessed a major shift in customer preference with the launch of compact UVs. The size of the large car segment has gradually shrunk, mainly due to the shift in customer preference towards the SUV segment, fewer model launches and availability of high-end technology features in the SUV segment compared with the large car segment.

PV sales split by vehicle segments



Source: SIAM, CRISIL MI&A

Key historical regulatory/macroeconomic trends and growth drivers for domestic sales and exports

BS-IV to BS-VI transition

BS emission standards are issued by the government to regulate the output of air pollutants from motor vehicles. In January 2016, the central government decided to skip BS-V and shift directly to BS-VI norms. It fixed the deadline on April 1, 2020, for the introduction of BS-VI emission norms.

Because of technological advancements and stringent emission norms, companies are gradually shifting from traditional combustion engine offerings to plug-in hybrid, strong hybrid, fuel cell and pure EVs (battery EVs). In the case of PVs, specifically with respect to pure EV technology, in the absence of engine sounds, it is imperative that noise, vibration and harshness (NVH) levels are low. To maintain safety and improve efficiency while keeping NVH levels low, there will be newer developments, including lightweighting and safety products.

Safety norms

The focus on road safety has seen a marked increase in the past few years, as evidenced by the number of safety norms introduced by the government. As per the Bharat New Vehicle Safety Assessment Programme (BNVSAP), commenced from October 2017, new cars sold in India need to go through mandatory crash testing and comply with voluntary star ratings based on results.

Other safety system includes a mandatory air bag for the driver. The government proposes mandatory airbags for the front passenger on all cars. For new models, the front passenger airbag was made mandatory from April 1, 2021, while for models being sold in the market, it was made mandatory from June 1, 2021, according to the notification issued by the government.

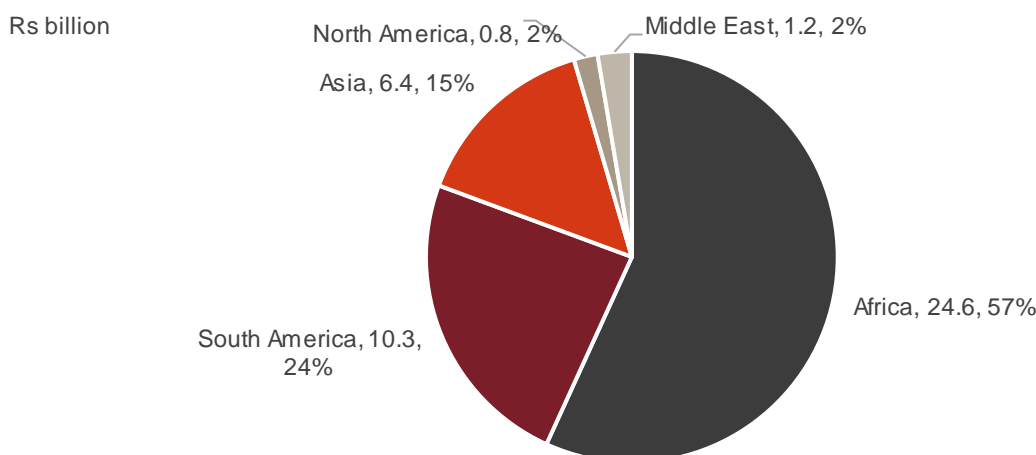
Some other safety measures:

- Seat-belt reminders
- Alert systems for speeds beyond 80 kmph
- Reverse parking alerts
- Manual override over the central locking system for emergencies

MEIS replaced by RoDTEP scheme

The central government decided to discontinue the Merchandise Exports from India Scheme (MEIS) from January 1, 2021, as it was not compliant with World Trade Organization norms. Exporters were reimbursed the duty paid on inputs through the new Remission of Duties or Taxes on Export Products (RoDTEP) scheme, which was notified on August 17, 2021. Rates for automobiles and auto components range between 0.5% and 2%.

Key export destinations (YTD fiscal 2023, April-November)



Source: Directorate General of Foreign Trade, CRISIL MI&A

Exports to Africa and the Middle East increased ~48% to 59% of PV exports during April -November 2022. Exports to South Africa increased to 19% of export share in fiscal 2022 from 9% in the pandemic-hit fiscal 2021. South Africa has become the major export market, surpassing Mexico, due to higher demand for entry-level vehicles. Newer markets such as Saudi Arabia and the US have also seen increases.

Future growth drivers for the exports market

While predominantly a small-car exporter, India has strongly emerged as an exporter of midsize sedans and UVs with a growing acceptance of vehicles manufactured in India. As a percentage of overall exports, the cars segment share reduced to 67% in fiscal 2022 from 80% in fiscal 2017. Consequently, the share of UVs increased to 30% from 19%.

Latin America occupies the highest proportion in PV exports from India, followed by Africa. Indian OEMs have diversified their exports by exploring newer geographies. New markets such as Saudi Arabia, the UAE and South Africa have shown significant demand growth.

Below factors are likely to support growth of PV exports from India:

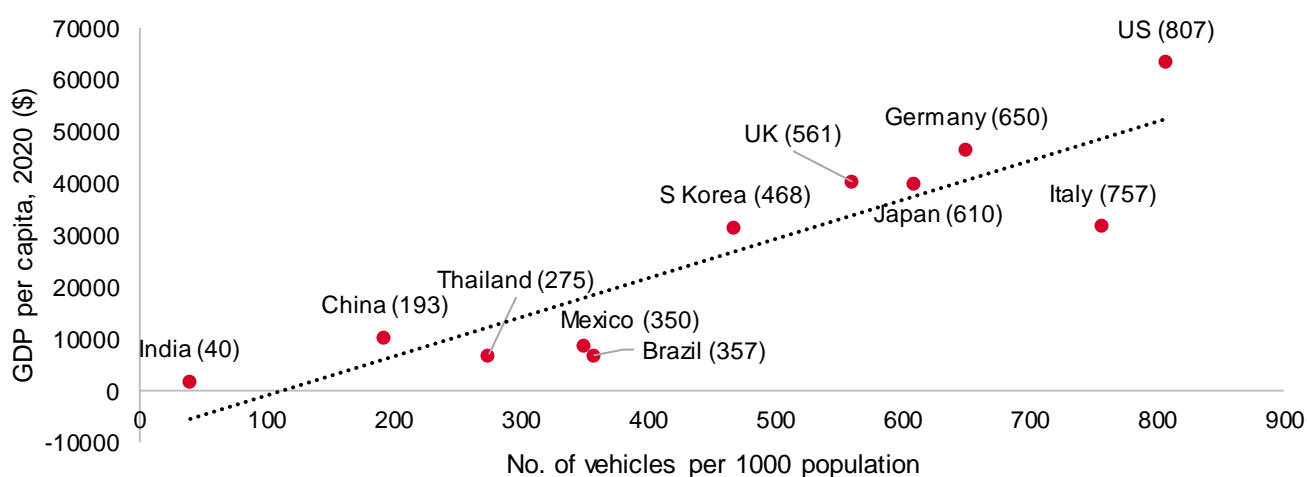
- Capacity expansion by top players
- Stable crude oil prices to aid demand from African and Latin American geographies
- Continued expansion into newer markets
- PLI scheme

Future growth drivers for the domestic market

Underpenetrated market presents significant growth opportunities for cars and UVs

India's car market is highly underpenetrated compared with that of most developed economies and some developing nations. As of fiscal 2020, India had ~40 PVs per 1,000 people. This is significantly lower relative to developed nations and even other nations in the BRIC block (Brazil, Russia and China), based on per-capita GDP. Brazil, Russia and China had 357, 393 and 193 PVs, respectively, per 1,000 people in 2020. Thus, the country holds tremendous potential for automobile manufacturers. Also, comparing on the basis of penetration of cars and UVs and per-capita GDP across countries, India still lags behind most countries and, as such, CRISIL MI&A expects the gap to reduce gradually in the long run.

Country-wise PV penetration



Note: Figures except for India are as of calendar year 2020. The dotted line indicates median. Figures in parentheses indicate passenger vehicles per 1,000 people

Source: World Road Statistics 2020, World Bank, CRISIL MI&A

Other factors that will drive growth in the domestic market include:

- Expected improvement in macroeconomic factors after subdued growth in fiscal 2020 and a decline in fiscal 2021
 - CRISIL MI&A expects India's GDP to grow 6.5-7% on average, annually, between fiscals 2022 and 2027, after estimated growth of 8.7% in fiscal 2022
 - GDP growth will continue to be consumption-led, assuming normal monsoons, softer interest rates and inflation, and implementation of Pay Commission hikes by states, which will push up purchasing power
- Anticipated improvement in rural demand
 - Rise in finance penetration in the long term, as banks and NBFCs continue to focus on semi-rural and rural areas, will contribute to increased rural demand
 - Rural infrastructure growth is expected to have a pronounced impact on rural incomes. Strong investments under infrastructure schemes will further boost rural infrastructure, with multiplier effects
- Improvement in finance availability
 - Given the industry's higher ticket sizes and better credit profiles of end-customers, finance penetration is higher in the PV industry compared with other automobile segments. CRISIL MI&A estimates finance penetration at 75-79% in fiscal 2021 (vs 75% in fiscal 2016)

- Stringent credit norms and availability of credit information through Credit Information Bureau (India) Ltd (CIBIL) have helped players widen their customer bases. The industry has witnessed strong competition with new players (such as NBFCs) targeting those markets that banks exited, and captive NBFCs (operated by two-wheeler manufacturers) largely focusing on non-metros
- Finance penetration is expected to deepen going forward, as:
 - more customers come under the formal financial services fold,
 - banks increase their focus on the retail segment, and
 - banks start waving off processing fee and pre-payment charges (especially during festival seasons), which will make financing option more lucrative for customers
- Enhanced product offerings
 - New models launched by manufacturers
 - Increase in offerings because of new entrants such as Kia Motors and MG Motors

Apart from rising sales of existing models, sales of new models have supported overall industry growth in the past few years. A majority of the models are in the UV segment, leading to its growth.

Impact of regulatory changes on domestic PV sales

Impact of Corporate Average Fuel Efficiency (CAFE) norms

The Paris Agreement, effective November 2016, and ratified by India, set the objective to limit the global temperature rise this century well below 2°C over pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. The greenhouse gas emissions reduction that would be compatible with this target would require a significant increase in the share of zero- or low-emission vehicles over the coming years. These regulations, combined with growing environmental and sustainability consciousness of the population, will lead to a major transformation of the global auto industry, from internal combustion engine to green mobility technologies (such as hybrid vehicles, BEVs, fuel cell vehicles and alternative-fuel vehicles).

Fuel consumption standards for Indian vehicles came into force in India in April 2017 for petrol, diesel, liquefied petroleum gas (LPG) and compressed natural gas (CNG) PVs. These standards are based on the CAFE system and target to bring about improvement in fuel consumption of PVs, supporting a continuous reduction in CO₂ emissions through CAFE regulations.

These regulations came into force from April 1, 2017, with the introduction of BS-IV emission norms. It was decided that the highest permissible carbon footprint would be 130 gm/km till 2022. Thereafter, it would be further reduced to 113 gm/km. This is expected to incentivise the shift towards greener technologies such as hybrids and EVs.

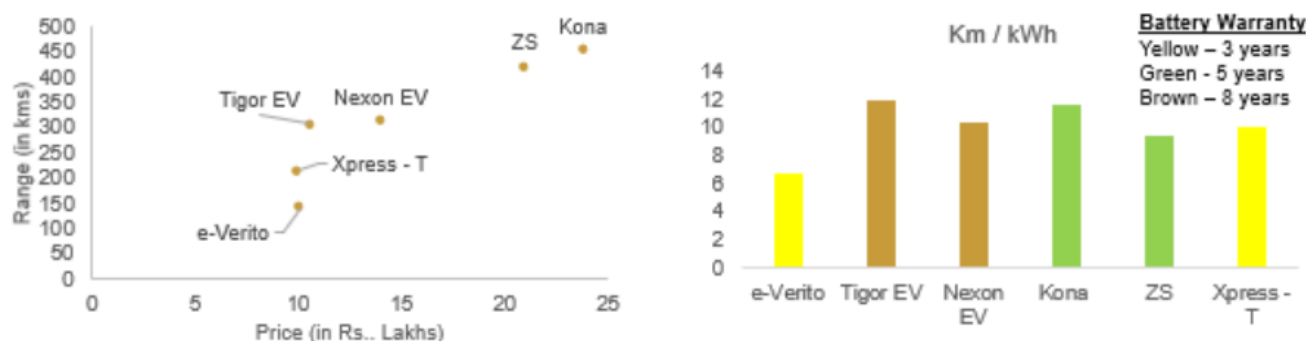
Upcoming regulatory changes and safety norms

The Indian PV industry has seen a host of safety and regulatory changes in the past 3-5 years. Implementation of CAFE norms will further aid in cleaner fuel emission. The government is considering making ESC and AEB mandatory on all models by 2023.

Penetration of electric PVs as of fiscal 2022

EV penetration in the PV category was just 0.6% in fiscal 2022, due to the unavailability of affordable electric cars and charging stations leading to range anxiety. Overall, EV retail sales stood at 20,525 in fiscal 2022.

EV models currently available



Source: CRISIL MI&A

Estimated penetration of electric PVs

Regulatory roadmap key for rise of electric mobility in India

The US and China are seeing an acceleration in sales of electric/hybrid cars, as most major global OEMs have one or more such models in their portfolios. With more model launches by OEMs, issues of range anxiety being addressed and declining battery prices, CRISIL MI&A expects EV volume to grow at a fast pace globally.

Currently, in India, the charging infrastructure required for EVs is not in place. With the Indian automobile industry seeing a slew of regulations and norms over the past few years, OEMs are skeptical about investing in EV manufacturing here.

The implementation of the National Electric Mobility Mission Plan 2020 is a key monitorable for the sector over the next five years.

Other policy initiatives by the government to address infrastructure-related issues

Policy initiatives	Features
FAME-II	The policy, with Rs 100 billion earmarked, aims to provide a subsidy of Rs 10,000 per kWh to four-wheelers (BEV, PHEV, strong hybrid) for commercial purpose and public transport. It also mandates the minimum range to be ~140 km and maximum ex-factory price to be ~Rs. 1.5 million. It envisions creation of infrastructure for charging of EVs. CRISIL MI&A expects the initial adoption rate to be high among cab aggregators.
EV policy	Delhi has announced an EV policy that would provide purchase incentives of up to Rs. 0.15 million for the first 1,000 electric cars. The benefit would be provided in addition to FAME-II policy benefits.
Tax and fee exemption	The Telangana government is providing 100% exemption on road tax and registration fee on purchase of the first 5,000 electric cars.
Tax exemption for BOVs	The Tamil Nadu government is providing 100% tax exemption for battery-operated vehicles (BOVs).

Such regional push will further accelerate the adoption of EVs. Individual taxpayers are allowed to avail a deduction for interest payments up to Rs. 150,000 towards EVs under Section 80EEB. The benefit is available on EV loans sanctioned over April 1, 2019-March 31, 2023. Such favourable tax laws are expected to encourage EV adoption for personal mobility.

The government is also considering the establishment of a 40-gigawatt (GW) battery manufacturing plant to boost EV and renewable energy initiatives. However, for any path-breaking changes to happen in the EV market, OEMs need to make more investments, and the government should devise clear policies. Among the challenges, infrastructure shortage needs to be resolved urgently.

Electric PVs to account for 6-8% of domestic sales by fiscal 2027

The FAME-II subsidy is incentivised only towards commercial use, and no benefits are provided to personal-car owners. CRISIL MI&A has analysed the ownership cost of an electric passenger car versus petrol, diesel and CNG variants for cab aggregators and for personal segments.

As of fiscal 2022, the total cost of acquisition (TCA) of an EV for a cab aggregator was ~17% higher than that of a diesel vehicle, 26% higher than a petrol vehicle, and ~16% higher than a CNG variant. In fiscal 2027, we expect the TCA of EVs to be lower than that of diesel and petrol variants, but higher than that of a CNG variant. On the other hand, the total cost of ownership (TCO) of EVs in fiscal 2022 was lower than that of petrol and diesel vehicles by ~29% and ~19%, respectively, and higher than that of a CNG variant by ~13%, attributable to the higher running of a commercial passenger vehicle and high fossil fuel prices. We expect the TCO of EVs to decrease further by fiscal 2027.

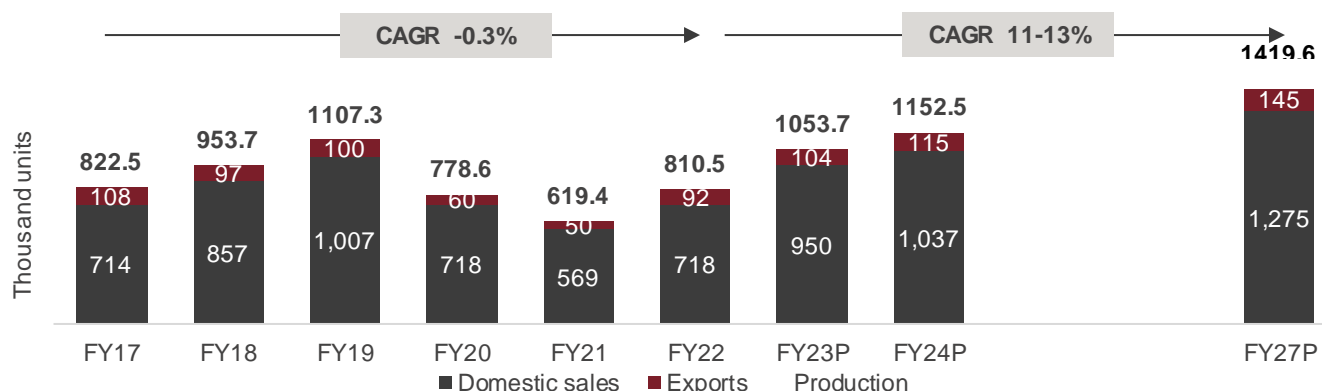
The lower battery cost (due to expected localisation led by the phased manufacturing programme or PMP) is expected to offset the lack of FAME subsidy and will help maintain the competitiveness of BEVs against diesel and CNG variants for cab aggregators in the long run. Currently, a limited number of charging stations, range anxiety and lack of large OEM presence are hindering EV adoption. The taxi segment accounts for 10-15% of sales within passenger cars, and within the taxi segment, cab aggregators are expected to lead the adoption of EVs (an estimated 25-31% adoption by fiscal 2027, considering that adequate infrastructure is available by then).

As of fiscal 2022, the TCA for EVs in the personal vehicles segment was lower than that for diesel, petrol and CNG variants by ~24%, 4% and 0%, respectively. In fiscal 2027, we expect the economics to remain the same – TCA of EVs is expected to be lower than that of diesel and petrol vehicles, but higher than petrol and CNG variants. This is due to lower registration charges for EVs amid high loan-to-value (LTV) ratios. On the other hand, the TCO of EVs in fiscal 2022 was 20-30% higher than that of all three variants. In fiscal 2027, we expect the economics to again remain the same – TCO of EVs is expected to be lower than that of all three variants by 10-20%. However, despite not-so-favourable cost economics, higher adoption has been witnessed initially by environment-conscious buyers. Accordingly, we expect EV penetration in this segment to reach 6-8% by fiscal 2027.

Review of and outlook on the Indian CV industry (fiscals 2017-27P)

The Indian CV market recorded domestic sales of 0.7 million units in fiscal 2022, contributing to ~4% of the total market of 2Ws, 3Ws, PVs and CVs by volume and ~20% in value terms at ~Rs 977 billion.

CV production development (fiscals 2017-27P)



Source: SIAM and CRISIL MI&A

Overall, CV production showed a marginal decline of 0.3% CAGR over fiscals 2017-22. Over fiscals 2016-19, production logged 12.3% CAGR, driven by pick-up in rural and industrial activity, and the government’s focus on infrastructure investment. A large portion of the production increase was on the back of robust demand for goods carriers, which clocked 14.1% CAGR. Passenger carrier production, though, declined by 1.7% CAGR.

Projected split by domestic sales and exports

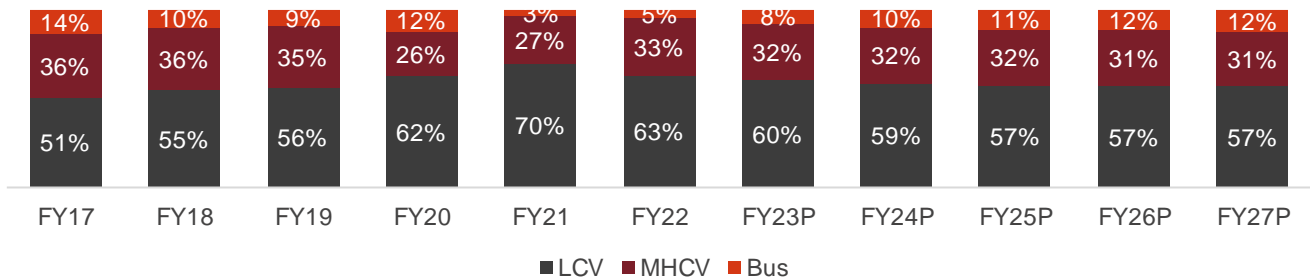
The Indian CV industry is expected to remain domestic-focused, with domestic sales comprising more than 85% share of production even in fiscal 2027. However, with exports projected to log 8-10% CAGR between fiscals 2022 and 2027, their contribution in overall production is likely to remain more or less equal to fiscal 2022 levels.

CRISIL MI&A expects domestic sales of CVs to clock 11-13% CAGR between fiscals 2022 and 2027, aided by healthy industrial growth, focus on infrastructure, and higher mining production. CV sales plummeted ~29% in fiscal 2020 and further by ~21% in fiscal 2021. The fall in sales created a low base, over which volume grew ~26% in fiscal 2022. On analysing the past five year rolling CAGR of domestic CV sales, despite a low base, the five-year CAGR between fiscal 2022 and 2027 will be similar to previous peaks. Tonnage growth will be marginally higher than volume growth as preference for higher tonnage vehicles is increasing among transporters.

On the exports front, manufacturers are directing their investments into expanding presence to other Asian countries from neighboring countries such as Bangladesh, Nepal and Sri Lanka and to Africa and the Middle East. Domestic players are also considering setting up assembly operations across multiple markets. Moreover, going forward, new product line-ups and technology upgradation will allow domestic players to enter relatively advanced markets of Southeast Asia. Consultations with the Sri Lankan government is likely to open the market again gradually for Indian exports soon.

Split by CV categories

CV segment-wise domestic sales

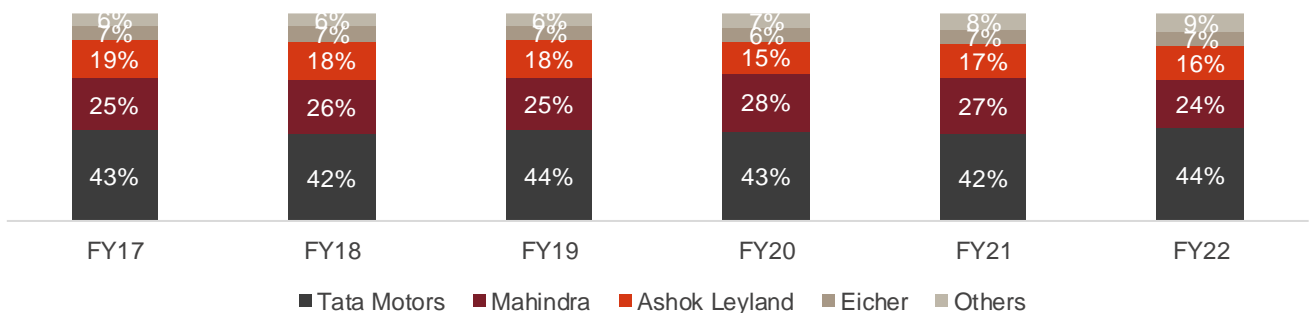


Note: Share of production is shown for OEM's which are part of SIAM

Note: LCV includes vehicles with gross vehicle weight (GVW) of less than or equal to 7.5 tonne; MHCV includes vehicles with GVW greater than 7.5 tonne

Source: SIAM, CRISIL MI&A

Production split by OEMs

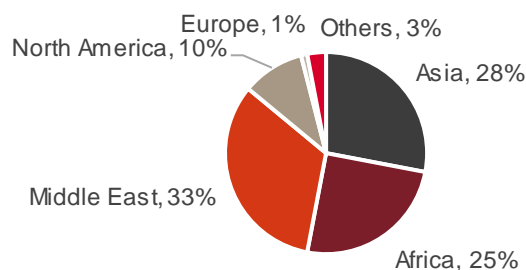


Source: SIAM, CRISIL MI&A

Historically, the domestic CV industry has been dominated by three players: Tata Motors, Mahindra & Mahindra (M&M), and Ashok Leyland (market shares of ~44%, 24% and 16%, respectively, in fiscal 2022). Among these players, market shares in different CV segments vary over time. A major reason for this is the fact that setting up a CV manufacturing facility requires high capital investment.

Over the last few years, leading CV manufacturers have significantly enhanced focus on technological innovations to develop the next generation of trucks and buses that have superior technology, conform to international standards and emission norms, and are able to compete with products from leading international CV manufacturers (thereby boosting exports).

Key export destinations (YTD fiscal 2023, April-November)



Source: Directorate General of Foreign Trade, CRISIL MI&A

Neighboring countries Nepal and Bangladesh continue to dominate Indian exports, with Asia contributing ~28% in fiscal 2023 (April-November). Bangladesh has become the second largest market following Saudi Arabia during the same period and South Africa accounted for ~10% of India's exports (vs. 8% in fiscal 2022) and Saudi Arabia for ~21% (vs. 13% in fiscal 2022).

Key trends and developments affecting CV demand

- **Fillip to industrial output:** CRISIL MI&A expects industrial GVA to bounce back strongly and log ~6.3% CAGR between fiscals 2022 and 2026, driven by the government's focus on 'Make in India' and growth in consumption, particularly led by growth in rural incomes. Also, coal production to clock ~6% CAGR between fiscals 2019 and 2024, driven by rising demand for electricity and the onset of commercial mining. Meanwhile, iron ore mining will also likely grow at a healthy pace during this period, aiding tipper demand.
- **Government's focus on infrastructure:** The National Infrastructure Pipeline (NIP) proposes to spend Rs. 111 trillion of capital expenditure on infrastructure sectors in India over fiscals 2020-25. Power, roads and bridges, urban infrastructure, digital infrastructure, and railways together constituted over 85% of total infrastructure investment. Of the total NIP investment of Rs. 111 trillion, 40% worth of projects are under implementation, 30% at the conceptualisation stage, and 20% under development. Almost 83% of project allocation indirectly benefits the CV sector in India, and this push for infrastructure is a major driver of growth.
- **Scrappage policy:** MoRTH, in August 2018, considered incentivising the scrapping of vehicles sold before April 2005 (15 years old). After deliberations on the modalities on implementation of the norm, the government currently aims to promote vehicle scrapping by exempting registration charges for truck purchases made after scrapping older trucks.
- **Commissioning of DFC to affect road freight and CV sales:** The DFC is intended to help the Indian Railways regain lost freight share by cutting turnaround times between importing and consuming destinations, compelling several industries to realign their logistics strategies. Not only will the DFC bring about faster freight movement, but it will also aid the economy by decongesting major highways due to the increased shifting of freight to rail. It will also allow for faster evacuation of cargo from ports, improving efficiency. Thus, roads, which have outperformed rail over the past decade, will lose some share to rail once the DFC is commissioned.
- **Demand for goods carrying MHCVs to lead in the next five years:** MHCV sales are likely to log 9-11% CAGR, over a low base, between fiscals 2022 and 2027. Factors driving long-term MHCV sales comprise improving industrial activity in the country, steady agricultural output, and the government's focus on infrastructure. However, volume growth will be limited due to efficiencies achieved from GST, better road infrastructure, and commissioning of the DFC.
- **LCV sales to grow at a modest pace in the long run:** LCV demand is expected to clock 8-10% CAGR between fiscals 2022 and 2027, due to higher private consumption, lower penetration, greater availability of redistribution freight, and improved finance. Improving volume of LCVs up for replacement in the terminal years would aid demand growth.

Key upcoming regulations

BS-VI phase 2 norms

BS-VI phase 2 is expected to be implemented from April 2023 and will entail addition of an on-board self-diagnostic device (OBD2) to monitor emissions in real-time. The addition of OBD2 will also require upgrade to hardware and software of the vehicles to comply with the new norms — this is expected to result in a price hike of 2-4%, as per our interactions with industry stakeholders.

New axle load norms

MoRTH has notified new axle load norms for CVs, which allow for an increase in the load-bearing capacity of trucks. The new axle load norms will be applicable to the entire fleet of freight-moving trucks — called the 'population parc'.

Truck body code

With standardisation in truck body building, there was consolidation among truck body builders as small players found it difficult to meet the testing requirements. With standardisation, financiers are believed to have been more willing to fund the generally unsupported body building cost. This is estimated to have reduced the initial down payment, minimising the impact of the 5% rise in the cost of ownership.

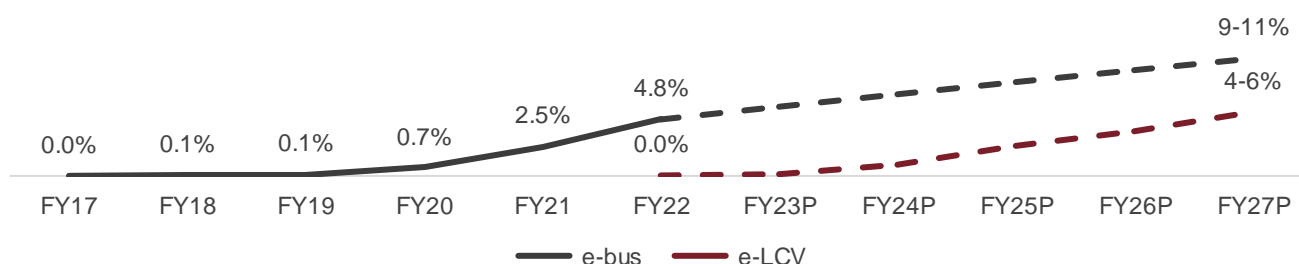
Fuel efficiency norms likely to be enforced by April 2023

To make heavy-duty trucks and buses more fuel efficient, the Ministry of Petroleum and Natural Gas, MoRTH, and the Ministry of Heavy Industries are in talks to notify fuel efficiency norms. As per a draft notification by MoRTH, fuel efficiency norms are likely to be enforced from April 2023. Based on talks with various stakeholders, BS-IV compliant diesel vehicles of categories M3 and N3, with GVW of 12T and above, will have to comply with these norms. Vehicles are expected to meet the 'target diesel fuel consumption' value for a specific set of speeds, which is dependent on the vehicle's GVW, axle configuration, and category (N3/M3).

Electrification in CVs

Electrification in the overall CV segment is expected to reach 5-7% by fiscal 2027, driven by electrification in LCVs and buses at 7-9% and 10-11%, respectively.

EV penetration in CVs



Source: SIAM, CRISIL MI&A

Electrification in PVs (buses)

Due to government support through FAME and focus on quicker adoption of EVs in public transport, e-bus sales have surged in the last couple of years. The operational profile of buses with fixed routes and regular stops makes them suitable for charging at pre-determined intervals and specific locations.

There could be some minor penetration of EVs in ICVs going forward; however, with respect to MCVs and MAVs, we expect the dominance of diesel fuel to continue with LNG making some inroads. The electric bus segment is expected to grow at a CAGR of 58% to 60% between fiscals 2022 to 2027, to reach more than 16,000 units in sales

Review of and outlook on the global power tools industry (2017-27P)

Power tools are devices that operate on an additional source of power apart from manual labour. Electric motors, internal combustion engines and compressed air (pneumatic) are the most commonly used power sources. Compared with conventional hand tools that solely depend on manual labour, power tools are more time-efficient and precise. Power tools make heavy-load tasks easier and more efficient.

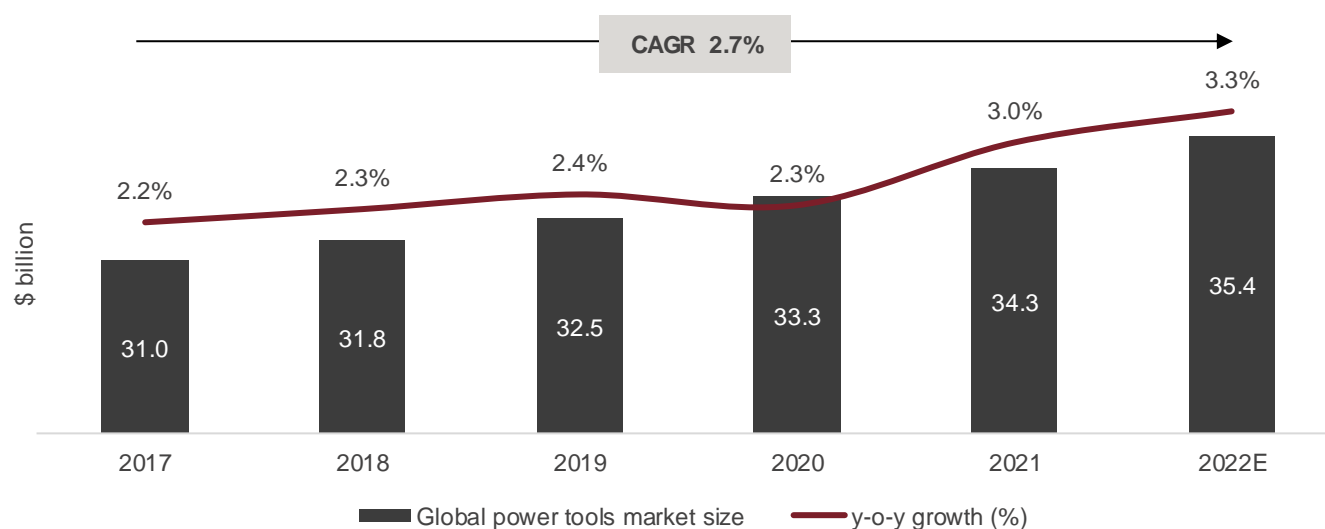
Power tools typically include power drills, impact wrenches, hammers, saws, routers and grinders, which are used in the construction, automotive, aerospace, shipbuilding and other industries. They are also used in the residential environment for home repairs, do-it-yourself (DIY) projects, etc.

Power drills are used for boring holes, driving screws, and electrical fittings, among other tasks, while impact wrenches are heavy-duty fastening devices used extensively in repairs, equipment maintenance and product assembly. Hammers are used in carpentry, framing, nail pulling, riveting, bending, shaping metal, etc. Saws, which consist of a tough blade, wire or chain with a hard-toothed edge, are used to cut through material. Routers are used to rout out an area from hard materials such as plastic or wood to make patterns, grooves, etc. They are portable electric power tools mainly used in carpentry, with a flat base and a rotating blade extending past the base. Grinders, as the name suggests, can grind metal and cut tile, stucco and pavers, and can also be used for deburring, finishing and polishing.

Review of the global power tool market size (2017-22)

Techtronic Industries, Stanley Black & Decker, Robert Bosch Tool Corporation, Apex Tool Group, Atlas Copco, Emerson Electric, Hilti Corporation, Ingersoll Rand, Koki Holdings, and Makita Corporation are some of the key players in the industry.

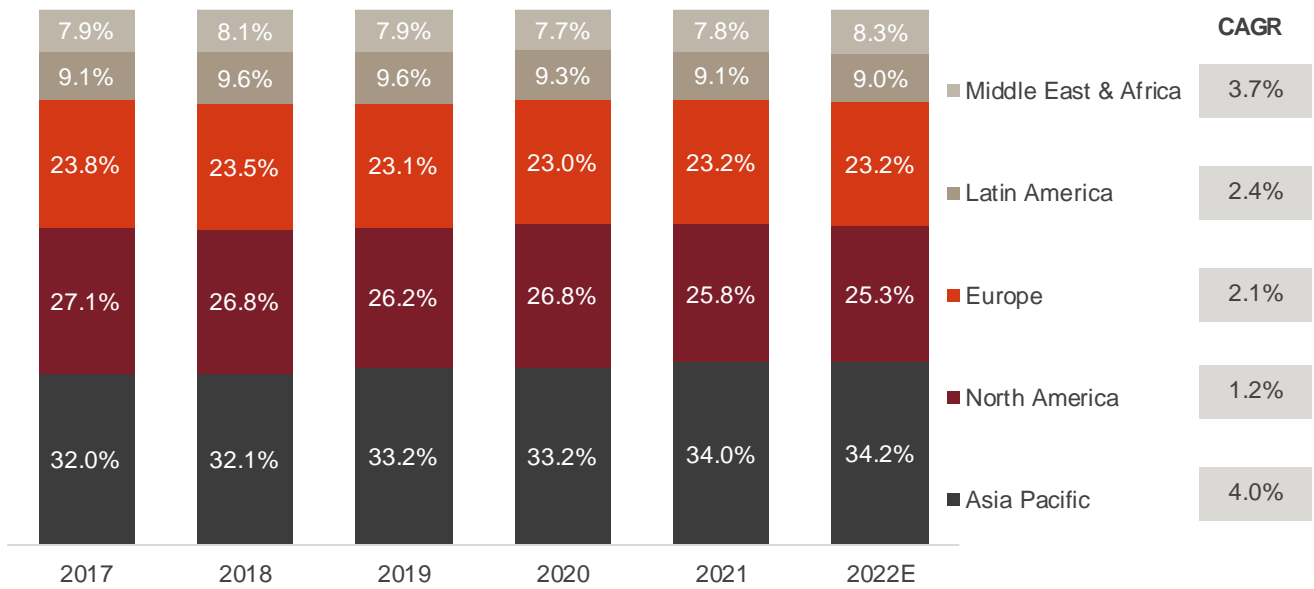
Global power tools market size (2017-22)



E: Estimated

Source: Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

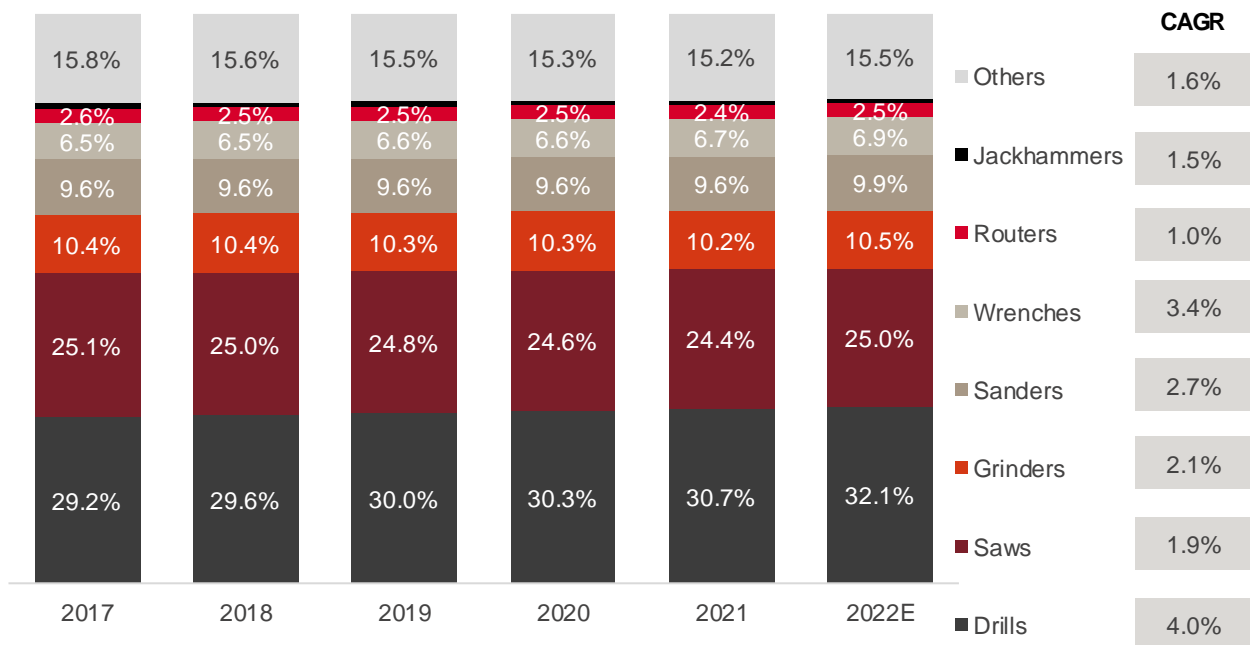
Share of key regions in the total global power-tools market (2017-22)



E: Estimated

Source: Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

Share of product types in the global power tools market (2017-22)

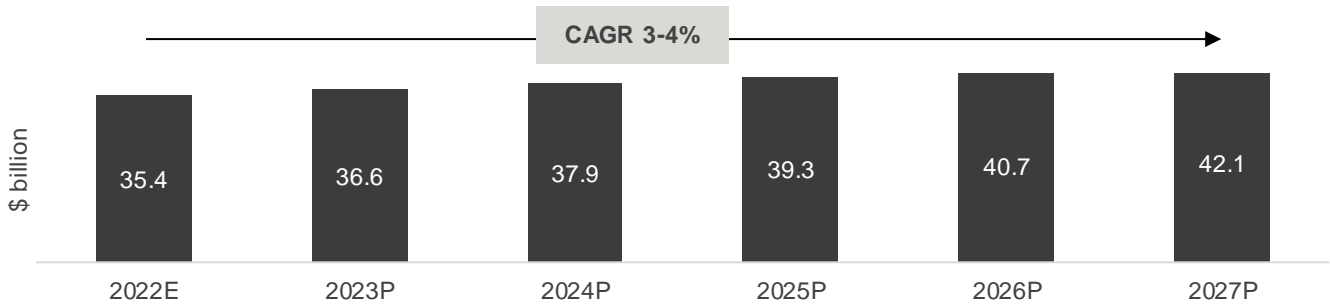


E: Estimated

Source: Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

Outlook on the global power tool market size (2022-27P)

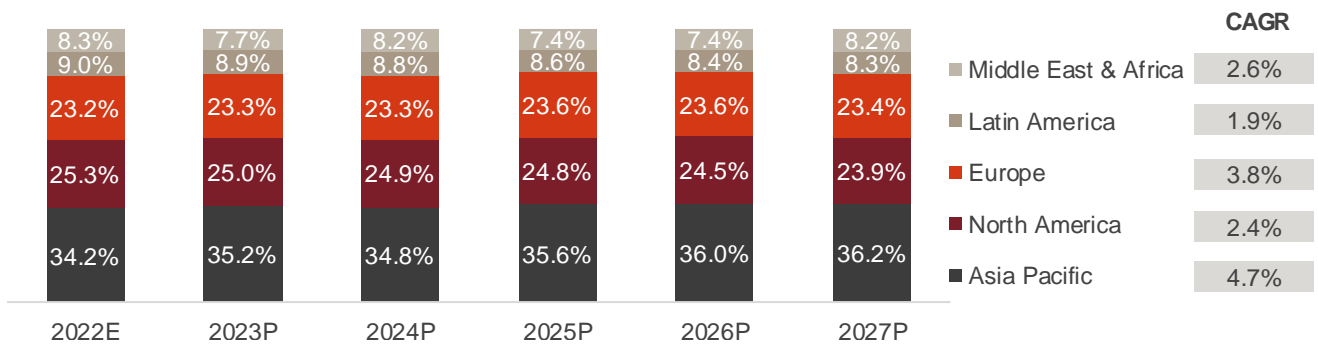
Outlook on the global power tool market size (2022-27P)



E: Estimated; P: Projected

Source: Crisil MI&A, Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

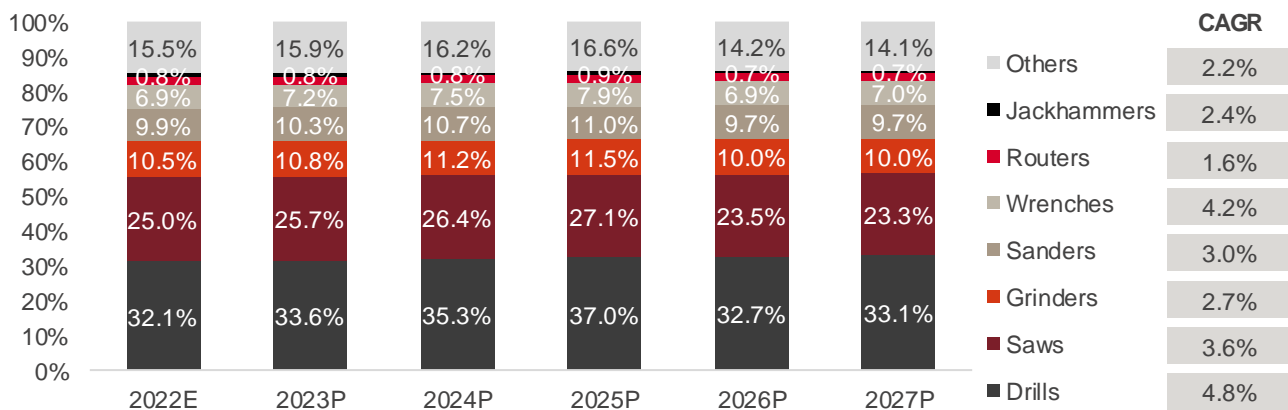
Share of key regions in the total global power tools market (2022-27P)



E: Estimated; P: Projected

Source: Crisil MI&A, Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

Share of product types in the global power-tools market (2022-27P)



E: Estimated; P: Projected

Source: Crisil MI&A, Power Tool Institute, ConstructConnect, US Census Bureau, UNComtrade, National Bureau of Statistics of China, ITC, Company Reports

Key growth drivers and challenges

Growth drivers

- Infrastructural growth, especially in emerging economies such as China and India, is a major driver of power tools market globally. The rise in labour costs in these markets is also expected to increase demand for efficiency-boosting power tools
- Technological advancement is a major growth driver. The popularity of cordless power tools is rising since battery-operated hammer drills, impact wrenches, circular saws, among others, are being used more often in construction, metal working, and repair and maintenance. Consequently, the advances in battery technology are also driving the industry to a large extent. Growing demand for smart power tools with wireless connectivity is also set to pick up in the coming years
- Changing customer behaviour in favour of DIY bodes well for the power tools market. The constant innovation in product design and safety features such as ease-of-use, ergonomic designs, safety, portability, multi-purpose machines, etc., would encourage adoption by domestic users. This segment would contribute to considerable growth since products are becoming more affordable and have better features

Challenges

- High initial prices of power tools are a major challenge in their adoption. Power tools feature various electronic components and assemblies. While technological advancements have improved their functionality, their prices also tend to be higher than those of conventional power tools
- Alternative affordable choices, such as leasing in developing economies, also pose a challenge to the growth of the power tools market
- Power tools are precision instruments, making their maintenance costs high. The large number of moving parts in these tools leads to wear and tear depending on the usage, and they need periodic recalibration. Repair of excessive wear and tear could even cost more than 50% of the replacement value of the products.
- Lack of awareness about many of these tools, their functions and technological advancements in the field also hinders market penetration to an extent

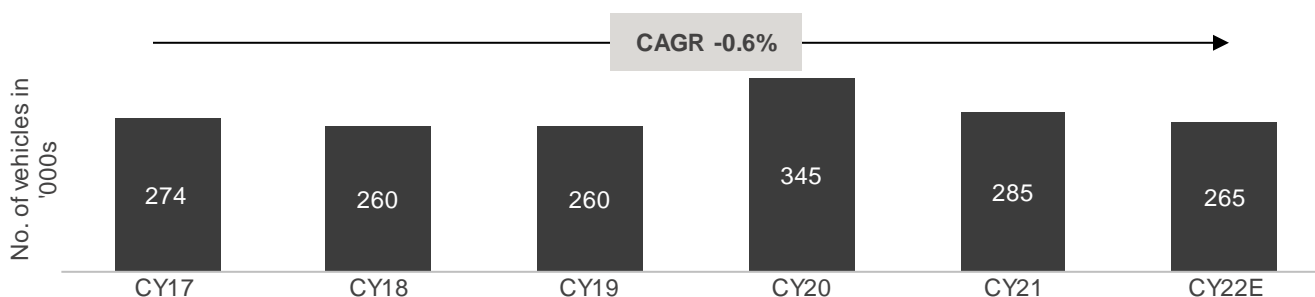
Review of and outlook on the global ATV industry (fiscals 2017-2027P)

Honda introduced all-terrain vehicles (ATVs) in the US in 1971. Given a booming market, several players such as Yamaha, Kawasaki, Bombardier and Polaris also entered the ATV market. The US market accounts for over 50% of worldwide ATV demand due to its large stretches of natural terrain, unpaved roads, and large ranches and farms.

The most popular ATV use is for general recreation, followed by farming/ranching, hunting/fishing, hauling/towing, transportation, and commercial use.

The rise of ATV training centres has also boosted acceptance of these vehicles among adventure seekers.

ATV sales development in the US (2017-22)

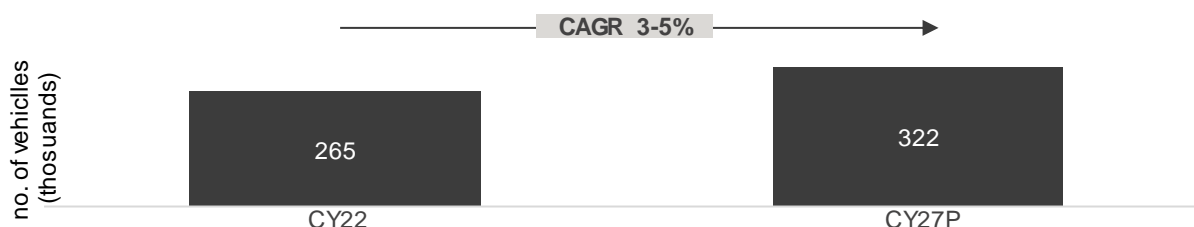


E: Estimated

Source: CRISIL MI&A, Company Reports

Outlook on ATV sales

US ATV sales outlook 2022-27P



Source— CRISIL MI&A, Company Reports

Factors such as a growing interest in recreational activities, worldwide championships, construction of dedicated trails for ATVs, increased acceptance in military applications, and increased safety requirements are likely to increase the demand of ATVs in the US. On the base of 2022, ATV sales are projected to grow at a moderate 3-5% CAGR till 2027. More than four-wheeled ATVs are projected to be the fastest-growing segment in the ATV market by 2027. A growing number of ATV buyers are looking for more than four-wheeled ATVs, especially in military and agricultural applications.

Market sizing and outlook on specific auto components

Overview of the auto component segments

The specific auto component segment includes advanced braking systems, aluminium light weighting precision solutions and safety control cables.

The advanced braking systems segment includes brake panel assembly, brake shoe, disc brake pad (DBP), brake lining, and mission case.

The aluminium light weighting solutions segment can be further segmented into various divisions including engine parts, body/chassis parts, transmission parts, electrical/electronics parts, and EV-specific components. The engine parts division includes crankcase, crankcase cover, filter housing, cylinder block, throttle body, and engine cover. The body/chassis division includes pillion grip, footrest, holder, speedometer housing, wiper housing, and hub. The transmission division includes flange final driven; the electrical/electronics division includes ECU plate/ECU heat sink. The EV-specific division includes wheel pulley, motor housing and battery housing.

The safety control cables segment includes choke cable, clutch cable, front brake cable, rear brake cable, speedometer cable, throttle cable, seat lock cable and fuel cable.

Advanced braking systems

Braking system is one of the most critical parts in a vehicle considering the safety involved. Braking solutions are increasing in importance and complexity with vehicle speed increasing given more powerful vehicles being introduced along with development in road infrastructure. Concurrently, the growing safety standards have also made these improvements essential. An effective braking system is needed to accomplish the task of stopping the vehicles at higher speeds while also ensuring higher life and lower noise. Current generation vehicles use disc brakes and drum brakes or a combination of the two to accomplish this task. In case of 2 wheelers and commercial vehicles, drum brakes constitute majority of the application whereas disc brake are prevailing in passenger vehicles. The growing need of safety systems in automotive will increase demand for efficient automotive brake components such as, brake shoes, brake pads, brake liners, brake calipers and brake panel assembly.

On a traditional braking system using only disc and/or drum, the energy is lost in the form of heat during braking. Many electric and hybrid vehicles (EVs) have regenerative braking systems where a part of energy typically lost in the traditional friction braking system when slowing down a vehicle can be recovered and stored in batteries in the vehicle to be used later. The system wastes less energy than it would with friction braking. Such a braking system offers less wear and tear on the brakes, extending the life of braking systems. Even though regenerative braking is available, EVs and hybrids are equipped with conventional brakes which must meet the same stringent criteria required of a safety system in traditional ICE vehicles. Also, during hard braking the disc and/or drum brakes play a critical role in stopping power of a vehicle.

Braking being a critical component of automotive systems due to their importance to road safety, have high entry barriers as these components are developed using proprietary material formulations, require technological prowess, manufacturing knowhow and R&D to develop products that are effective and economical. The materials used for producing the abrasive braking material such as brake linings used in brake shoes and brake pads have evolved over time from simpler asbestos-based materials to high-tech products made of semi-metallic, steel, and ceramic products for high end vehicles. The auto-components industry is capital-intensive in nature, coupled with heavy dependence on complex technology, machinery and systems make it difficult for new entrants to encroach upon, due to its high entry barriers. General competitive factors in the market, which may affect the level of competition over the short and medium term, include vulnerability to overall macroeconomic factors, time to market for new products, product features, safety, design, quality, price, and relationships between producers and their customers.

Consulting

Given their criticality to automotive systems, a high level of accuracy and adherence to high safety standards is also required. This necessitates coordination between component manufacturers and OEMs throughout the product development cycle from design to testing, validation to delivery. As a result, OEMs typically have an extensive and detailed vendor approval process and generally have long gestation periods to onboard a new supplier. The significant time and effort in the approval process results in OEMs typically preferring not to switch vendors unless there have been specific quality and cost issues.

Key players in the automotive braking solutions market are ASK Automotive, Brakes India, Allied Nippon, and Rane Brake Lining.

Drum brake assembly and disc brake assembly

Drum brake panel assembly: Brake panel assembly is an assembly of duly machined and painted casted panel, brake shoe and child parts (arm, lever, spring etc.). Panel casting is manufactured on high pressure die casting machines wherein molten aluminium alloy is used as input. Brake drums rotate with the wheels and there are brake shoes inside each drum. On braking, lever actuates through brake cable to generate braking force, thus decelerating the vehicle. Key components in a braking system include brake shoes and brake lining.



Source: ASK Automotive

Brake shoes: Brake shoes are frictional surfaces used in the drum brake system. Brake shoes carry frictional material (brake lining) bonded to a curved/crescent-shaped metal and sits inside the brake drum. Brake shoes are forced against the inner surface of brake drum to generate friction which reduces the speed of the vehicle.

Brake shoes wear out gradually over time. If worn excessively, the brake shoes will not be able to produce adequate braking force and the rider will experience poor braking. Also, an excessively worn brake shoe can make the metal part of the shoe touch the brake drum, producing excess noise and may damage the brake drum. Hence due to wear and tear the brake lining is worn-out and brake shoe needs to be replaced. Over time materials used for manufacturing brake shoes has evolved from simple asbestos-based materials to high-tech materials made from semi-metallic, low steel etc.



Source: ASK Automotive

Disc brake pad (DBP): Disc brake pads are frictional surfaces used in the disc brake system. Brake pads are made of frictional material (brake lining) bonded to a metal backing plate. The brake pads are forced against the disc rotor to generate the friction needed to stop the vehicle. Disc brake pads sit within the brake calipers affixed to the wheel hub. There are usually two brake pads per disc rotor which function together in a disc brake assembly. In the past, brake pad linings were made from simple materials such as asbestos. However, today's brake pad linings are made of high-tech abrasive materials of semi-metallic, low steel, non-steel, and metallic types, that can provide high stopping power and last much longer under very demanding conditions based on vehicle usage.



Source: ASK Automotive

Brake lining: Brake lining is the consumable surface in the brake system which is tough and made of heat-resistant material. During braking, brake linings apply frictional force to a brake drum to reduce vehicle speed. Brake linings are used in both drum and disc brakes. The former consists of a brake drum and brake linings attached to brake shoes, and the latter consists of a brake pad carrying brake lining. Mostly the brake lining is riveted to the brake pads and shoes. As the brake lining wears, the brakes may chatter, squeak or squeal. If the brake lining continues to wear, the rivets would begin to damage the disc rotor or drum, necessitating costly brake repair.

Mission case: Mission case is an essential part of braking system used in rear wheel of scooters and alternate to brake panel assembly in the rear wheel of scooters. Mission case is an aluminium alloy casing which houses and protects the transmission gears and brake shoes mounted on the backside of the mission case. On braking, lever actuates through brake cable to generate braking force, thus decelerating the vehicle.



Source: ASK Automotive

Review of and outlook on the advanced braking systems market (fiscals 2022-27P)

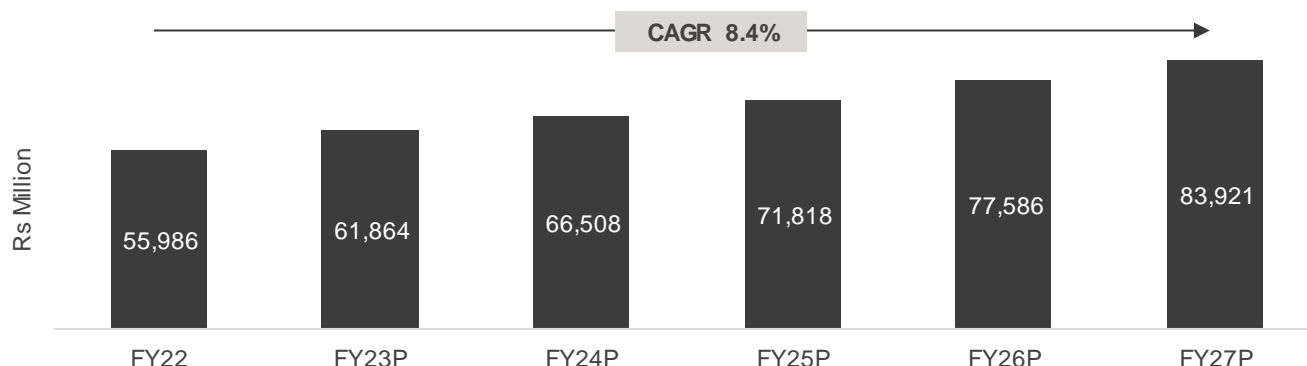
As mentioned above, advanced braking systems include products such as brake panel assembly, brake shoes, DBP, brake lining, and mission case catering to multiple automotive vehicle segments including motorcycles, scooters, passenger vehicles, and commercial vehicles in both the internal combustion (IC) and electric vehicles (EVs) segment. Based on the vehicle category, the products applicable for each of them varies as below:

Segment	Component	Market	Channel
Two-wheeler	Brake panel assembly, brake shoe, disc brake pad (DBP), mission case	Domestic	OE and AM*
Three-wheeler	Brake shoe	Domestic	OE and AM
Passenger vehicle	DBP	Domestic	OE and AM
Commercial vehicle	DBP, brake lining, body (modulator/park relay)	Domestic and export**	OE

*AM estimated for brake shoe and DBP

**Export is estimated for DBP and brake lining

Advanced automotive braking systems market size (fiscals 2022-27P)

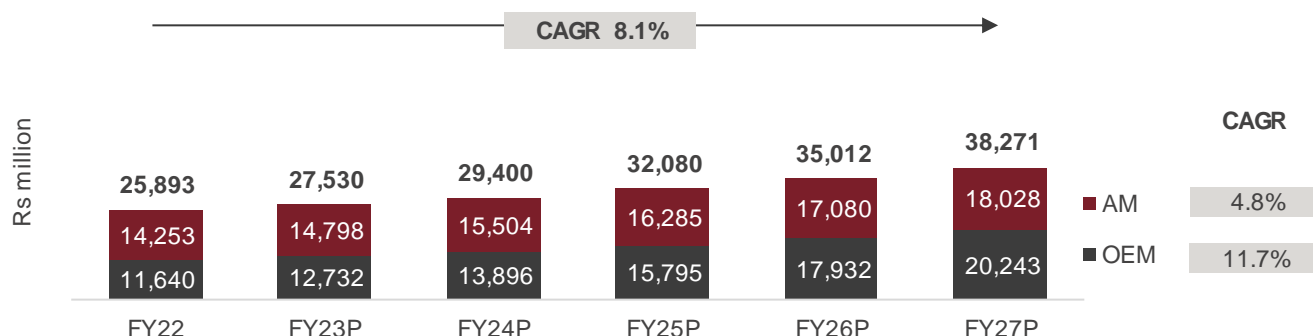


Source: CRISIL

The advanced braking systems market — including the sale to domestic OEMs, aftermarket, and export — is estimated at Rs 55,986 million in fiscal 2022. Advanced braking systems are expected to grow at 8.4% CAGR over the next five years through fiscal 2027 to reach Rs 83,921 million. The market would be majorly driven by the fast-growing passenger vehicle segment, followed by two-wheeler and commercial vehicles. Based on the above segmentation, two-wheeler is a major contributing segment for the braking solutions market. Almost all vehicle segments would log robust production growth over fiscals 2022-27. The production of two-wheelers, three-wheelers, passenger vehicles, and commercial vehicles is projected to grow at 10-12%, 12-14%, 10-12%, and 11-13% CAGR, respectively, over the forecast period, driving the OEM market for braking solutions. Key macroeconomic trends are also likely to aid demand for two-wheelers, three-wheelers and passenger vehicles over the medium to long term. Urbanization will reach 37-38% by fiscal 2027 from ~35% in 2020, driving the adoption of two wheelers for city commute. The production-linked incentive (PLI) scheme for the automobile industry is likely to propel exports, thereby supporting demand for auto components in India.

Review of and outlook on advanced braking systems in two- and three-wheelers

Automotive braking systems market size for two- and three-wheelers (fiscals 2022-27P)



AM includes original equipment spares (OES), independent aftermarket (IAM) and unbranded segments

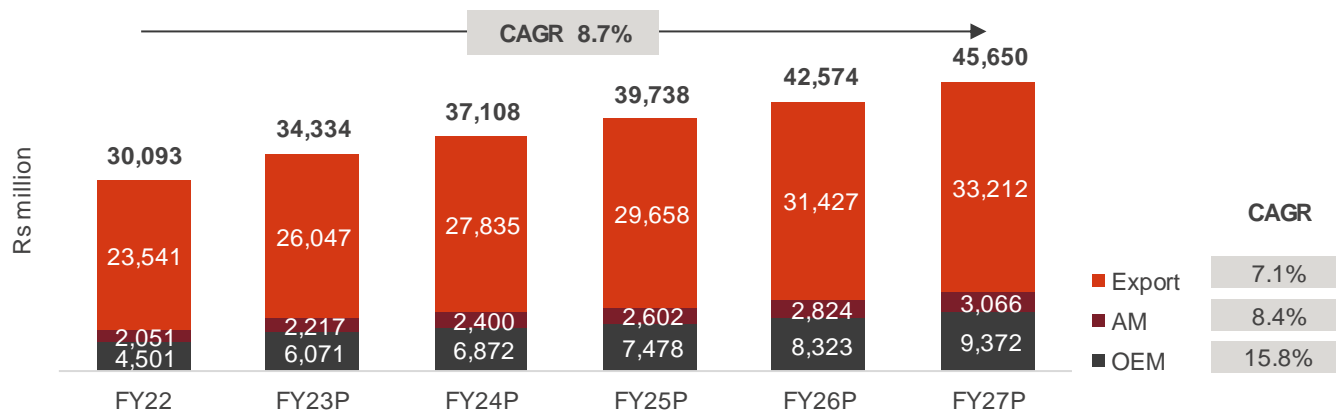
Source: CRISIL

Market for advanced braking systems is estimated to have stood at Rs 25,893 million in 2022 and is projected to clock a CAGR of 8.1% between 2022 and 2027 to reach Rs 38,271 million. Key players in the braking solutions market are ASK Automotive, Allied Nippon, Endurance Technologies, and Brembo. ASK Automotive has the leading market share in the brake-shoe and advanced braking segment in India, in terms of production volume (units) for 2W OEMs, with a market share of about 50% in fiscal 2022 for OEM, and branded AM combined.

Review of and outlook on advanced braking systems in PVs and CVs (fiscals 2022-27P)

Advanced braking systems in the PV segment include DBPs. Intensity of DBPs used in each vehicle changes based on the OEM configuration. Most of the lower or medium-priced cars use drum brakes or a combination of disc and drum brakes, whereas higher priced cars use disc brakes on all four wheels. In case of the former, the number of DBPs could be zero or four, and in the latter case, it would be eight. Domestic market for EV advanced braking solutions is growing as most OEMs are planning the launch of new EV models. Although most of the modern EVs uses regenerative braking systems, traditional braking systems, which are compatible with these new technologies, are expected to play a major role. Advanced braking systems in the CV segment include brake lining and body (modulator/park relay). Intensity of brake linings used in each vehicle changes with the number of axles.

Advanced automotive braking systems market size for PVs and CVs (fiscals 2022-27P)



AM includes OES, IAM and unbranded segments

Source: CRISIL

Market for advanced braking systems stood at an estimated Rs 30,093 million in 2022. The market is projected to log a CAGR of 8.7% between 2022 and 2027 to reach Rs 45,650 million. Among the products considered, OEM braking solutions is the

fastest growing segment; however, export market is largest. Key players in the braking solutions market are Brakes India, Ran e Holdings, Bosch, Allied Nippon, Sundaram Brake linings, ASK Fras-le, Hindustan Composites, and Masu Brake Pads.

Aluminium lightweighting precision solutions

Lightweighting is a crucial aspect for the transport sector in improving vehicle performance, energy efficiency and emissions , and making safer vehicles. Aluminium is the most used metal by automakers for lightweighting while improving performance standards, safety, and corrosion. According to European Aluminium Association, aluminium can be 40% lighter than steel, is used to build lighter and stronger vehicles. The metal possesses high thermal conductivity which can assist in moving heat away from critical components such as battery and electronics in an electric vehicle where high heat can adversely affect the performance and safety of the vehicle. Hence, aluminium is also finding growing application in EVs. With EVs penetration increasing, application of aluminium in automobiles is expected to grow as the use of this metal would improve the performance of EVs, due to lighter weight the efficiency of the vehicle can increase translating to higher range for a given size of battery, lowering the range anxiety expressed by customers. With high focus on energy efficiency and range anxiety in BEVs, light weighting is gaining increasing focus of automakers globally. Even in ICE vehicles, the need to lower greenhouse gas emission has seen adoption of materials such as aluminium and magnesium which are used to make thinner body panels and other structural members which can improve fuel efficiency.

Light weighting can be best achieved by using aluminium alloy as it is significantly lighter than ferrous alloys and exhibits the desired mechanical strength, elongation, high level of soundness and integrity, pressure tightness even at high pressure and heat dissipating properties as per system and vehicle requirement. Precision aluminium alloy parts is another critical requirement of the industry and offers very high level of dimensional repeatability, casting internal soundness and integrity , ability to be heat treated there by providing enhanced performance of the automotive system/vehicles. Apart from this aluminium alloy are also environment friendly and meets the ELV (end-of-life vehicles) compliance standard requirement. Overall, aluminium light-weighting systems and products improve performance and efficiency by reducing the weight of components, and assist in heat management, thereby increasing durability.

Many parts in automotives are made from aluminium including engine parts, body/chassis parts, transmission parts and various housing used in multiple segments. Also, due to increase in electronic controls in vehicles, aluminium alloy content is increasing continuously due to heat dissipation properties. Aluminium alloy is widely used for battery housings, covers, transmission housings, transmission pullies, traction motor housings, inverter housings, wheels, AC system parts and structural members for EVs as upcoming mainstream automotive market. All the products are aimed at offering higher performance while lowering the overall weight of the vehicle. Application of aluminium alloy in automotive and non -automotive is expected to grow as use of this would improve the performance of BEVs lowering range anxiety. Most automotive component manufacturers use die casting to manufacture aluminium-based automotive parts.

Engine parts

Engine is the backbone of any automobile as being powertrain unit. Inside the engine, ignition and combustion of fuel take place, converting the energy from combustions into heat and mechanical torque offering mobility. The engine is made up of several individual components working simultaneously. Some important engine components are engine block, crankcases and covers, cylinder head, cylinder head covers, oil pump, piston, oil pan etc.

Crankcase: Crankcase is an essential component of ICE two-wheelers. It houses a motorcycle's entire crank mechanism including piston, cylinder and connecting rods, notably crankshaft. Transmission components and engine control components are also attached to the crankcase. Crankcase is the body that holds engine parts together and must be designed to be both light and strong. Crankcase is integrated into the engine block and protects engine parts from debris such as dust, water, and mud.

Crankcase stores lubricating oil required for lubricating the engine parts. Crank cases are best combination of light weighting and precision machining and are most critical parts in terms of manufacturing processes and integrated controls.



Source: ASK Automotive

Crankcase cover: Crankcase cover is the casing made of aluminium alloy that encloses the crankshaft of an ICE. Crank case cover offers superior aesthetics and heat dissemination to the crankcase while protecting it from contaminants including dust, sand, and water.



Source: ASK Automotive

Filter housing: Oil filter housing offers a secure enclosure for the oil filter in the engine bay and allows engine oil to flow through the oil filter efficiently reach vital engine parts. It connects the oil filter with the engine by holding it in a single place. It is also placed right next to the engine cover, which makes it easy to access whenever needed and allows safe filtration without leakages. Filter housing makes filter easily accessible, practical, efficient, and thus saves labour cost, and allows safe filtration without leakages. Filter housings are strong, and since they are usually inside the engine bay, they are extremely durable. Without the oil filter housing, engine oil would not be able to flow through the oil filter efficiently and if contaminated/dirty oil circulates through the engine, it can damage the engine overtime.



Source: ASK Automotive

Cylinder block: A cylinder block is the most critical part of the engine engaged into generation of power. The upper part of the structure contains cylinders and pistons. Lower section forms the crankcases and supports the crankshafts. Cylinder block houses engine cylinders, which serve as bearings and guides for the pistons. Cylinder block encloses the connecting rod, piston, and crankshaft, and provide a sealed movement within the block.



Source: ASK Automotive

Typically, cylinder size and number of cylinders in the engine are measured to determine the power of the engine and cubic capacity (cc). There are two types based on their construction: single and twin cylinder engine. Single cylinder engine is inexpensive but is less responsive than engines with higher cylinder count for a given engine size, though it cools down much faster than other engines. Twin cylinder engine is available in different variants, which include straight-twin, V-twin, flat-twin, and tandem-twin, which offer better performance compared to single cylinder engine.

Throttle body: In ICEs, throttle body is the part of air intake system that controls the amount of air that goes into the engine. It houses throttle plate (butterfly valve) that rotates on a shaft to vary the amount of air intake. On acceleration, the valve opens and allows air into the engine, whereas on deceleration, the valve closes and blocks air flow into the engine. This process effectively controls the speed of the engine and, thus, speed of the vehicle. Throttle body is located between the air filter and the intake manifold and is connected to the accelerator mechanically or electronically.



Source: ASK Automotive

Engine cover: The purpose of engine cover is to protect the engine bay from debris and reduce the engine noise while adding a cleaner look to the engine assembly. Most of the engine covers are manufactured using the casting mechanism and different alloys/metals based on the light weighting or application needs.



Source: ASK Automotive

Body/chassis parts

Body/chassis parts include structural parts that offer comfort and safety to passengers. Chassis is the base structure of any vehicle that supports it from underneath. It supports all parts of the automobile including the powertrain, steering, transmission, suspension, and braking system. Body or the exterior structure of vehicles is either constructed separately and bolted to the chassis or manufactured integral with the chassis. Together chassis and the body make the complete vehicle. Some of the body parts include windows, roofs, doors, door handles, etc, in PVs and handle, footrest, pillion grip, etc, in two-wheelers.

Pillion grip: Pillion grip offers holding point for pillion riders and offers support and safety on the motorcycle. Pillion grip protects the pillion rider from falling in case of abrupt increase or decrease in speed, thereby enhancing safety. Pillion grip could be the grab handles or pillion grab rails, which are installed on both sides, offering comfort to pillion passengers, and allows rider to bring the motorcycle to main stand.



Source: ASK Automotive

Footrest assembly: A footrest is a non-moving piece of metal with rubber attachment over it where riders can keep their feet. A motorcycle will have designated footrest for riders and pillion riders. Footrest in two-wheeler is mainly for comfort, convenience and safety of the rider and pillion rider. Footrest assembly generally includes a pair of footrests, each fixed on either side of the two-wheeler for supporting respective foot of the rider. Footrest is pivoted to the lower portion of the body of the two-wheeler and is adapted to support the corresponding foot of the pillion rider. In the pillion rider configuration, footrests on both sides can be manually moved to be folded inwards or unfolded outwards. In case of scooters, footrests are placed inside the body to offer superior aesthetic appeal.



Source: ASK Automotive

Speedometer cable housing: Speedometer contains the mechanism to display various operating parameters of a vehicle such as engine rpm, speed, indicator status and engine status. Speedometer cable housing is a metal casing that surrounds speedometer and cable, thus preventing it from getting damaged.



Source: ASK Automotive

Wiper housing: Wiper is used to remove water, dirt, snow, or any debris from the vehicle windshield. All motor vehicles including cars, vans, buses, and trucks need to be equipped with one or more such wipers legally. The metal arm is powered by an electric motor with adjustable speed. Some vehicles are fitted with wipers on rear window as well. Rear window wipers are usually found on hatchbacks, SUVs, wagons, and other vehicle types with more vertically oriented rear windows that tend to accumulate dust. Modern day vehicles have automatic wipers that detect the presence of rain using rain sensors and operate without human assistance. Wiper housing encloses wiper components including the wiper arm, motor and crank supporting it. The motors are contained in metal housings, and each housing has connections for electrical wires and wiring harness to operate the wipers.



Source: ASK Automotive

Hub: Hub is a critical component of the wheel, which houses the drum brake assembly. The brake drum is a cylindrical hollow metal that is attached to the vehicle wheel and rotates at the same speed as the vehicle. The brake drum protects brake parts and inner rim of the drum acts as braking surface. Brake drum houses brake shoes fitted with brake linings, that are pressed against the drum to generate friction necessary to stop or decelerate a vehicle.



Source: ASK Automotive

Transmission parts

Transmission is responsible for transferring power from the engine to the wheels. The transmission ensures that engine runs at an ideal rate while powering wheels with the right amount of power to accelerate/decelerate. Key components of a transmission system include clutch, gearbox, differential, gears, and bearings.

Flange final driven: Final drive is the last step in transferring engine power to motorcycle rear wheel. During the primary stage of power transmission, the engine transfers power to the crankshaft and this in turn moves to the gearbox. In the final drive, power transmitted from the gearbox to the rear wheel to get the bike moving. There are three different types of final drive systems: chain, belt, and shaft drive. Chain drive system is very common. Flange final driven is attached to the rear wheel and sprocket final driven.



Source: ASK Automotive

Wheel pulley and intermediate pulley: Pulley acts as a transmission mechanism in electric vehicles and are used in belt driven vehicles. They transfer power from the electric motor to the intermediate pulley and in turn to rear wheel through a wheel pulley mechanism. These pulleys are made of lightweight aluminium alloy and gears on outer periphery are also as cast with zero draft allowance. Gear profile tolerance is <100 microns in as cast condition and is extremely critical for vehicle noise. Molten metal feeding system is designed differently to ensure highest level of integrity and casting internal soundness at centre hub and spokes area. The design is successfully migrated from sintered material to aluminium alloy to achieve weight targets and thus lowering range anxiety.



Source: ASK Automotive

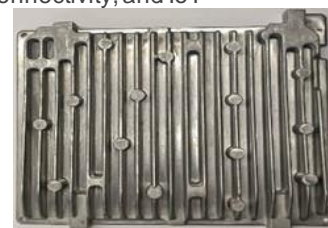
Motor housing: Motor housing covers the internal body of electric motors offering a definite shape and size, improving the performance. It protects the motor from dust, water or debris and damages during accidents. The motor housing is mounted to the chassis like an engine block and holds the traction motor. The part is extremely critical due to light weighting, precision machining and heat dissipation requirements.



Source: ASK Automotive

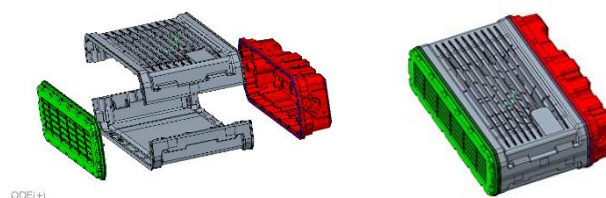
Electrical/electronics unit

Electronic control unit (ECU) plate or ECU heat sink: The shift of vehicles from mechanical to electronic systems has increased and the number of innovations such as infotainment, power steering, cruise control, connectivity, and IoT technologies are becoming mainstream. These electronic devices are controlled by an ECU. ECU in a vehicle would be attached to a metallic object called an ECU plate/ECU heat sink that can draw heat away from the device, to prevent damage from overheating. Heat sink increases heat flow away from a hot electronic device, keeping the device cool and thus improving its performance and extending its service life. It accomplishes this task by increasing the device's working surface area. Majorly heat sink is manufactured in aluminium alloy.



Source: ASK Automotive

Battery housing and covers: Battery is the key element of EVs and is an expensive component. Battery is estimated to account for 40-50% of the total cost of an EV. Battery housing protects the battery in the event of a crash. An efficient battery housing has many attributes that aid battery safety and assist in thermal management, while protecting the battery from the harsh environment under the vehicle and in an accident. Battery housing consists of four primary structural pieces: top cover, bottom cover, internal structure, and side impact crash protection structure. Battery housing should offer superior fire protection and must protect passengers in the event of a fire (thermal runaway). Battery housing can withstand side impact, bump on the road, or a foreign object striking it from below. On the other hand, it must be as light and compact as possible to make the most efficient use of the installation.



Source: ASK Automotive

Review of and outlook on the aluminium lightweighting precision solutions market (fiscals 2022-27P)

The aluminium lightweighting precision solutions market includes segments covering engine parts, body/chassis parts, transmission parts, electrical/electronic- and EV-specific components, catering to the motorcycle, scooter, passenger vehicle, commercial vehicle segments for both internal combustion engine (ICE) and electric vehicles. The aluminium die casting market in India will be led by the availability of skilled workforce and government incentives for MSME businesses, emission norms in the automotive segment, and favourable domestic and export scenarios for the automobile sector. EVs are set to increase the demand for aluminium components as the increased adoption of electrification to result in additional focus on light weighting thereby increasing the usage of aluminium products in the 2W, 3W and PV segment. Aluminium helps in reducing the vehicle weight thereby improving the range of EVs. New product innovations for use in EVs could raise the average quantity of aluminium used per vehicle in India to match global standards. Applications of aluminium in EVs include lightweight battery casings, motor housings and heat exchangers, besides overall structural integration. The ability to absorb a larger amount of crash energy, better strength-to-weight ratio ensuring vehicle performance enhancement is key attraction point of aluminium.

These components are manufactured using complex engineering processes. Given their criticality to automotive systems, a high level of precision and adherence to high standards of quality is also required. This necessitates close coordination between component manufacturers and OEMs throughout the product cycle from design to testing and validation to delivery. As a result, OEMs typically have an extensive and detailed vendor approval process and generally have longer gestation periods to onboard a new supplier. The significant time and effort in the approval process results in OEMs typically preferring not to switch vendors unless there have been specific quality and cost issues.

Major players in the industry include Endurance Technologies, Craftsman Auto, Sundaram Clayton Limited, Rico Auto Industries, Rockman Industries, Sunbeam Lightweighting, Sandhar Group and Aicon Castalloy. ASK Automotive is among the

prominent players in the aluminium lightweighting precision solutions segment in India for 2W OEMs with 8% market share in fiscal 2022.

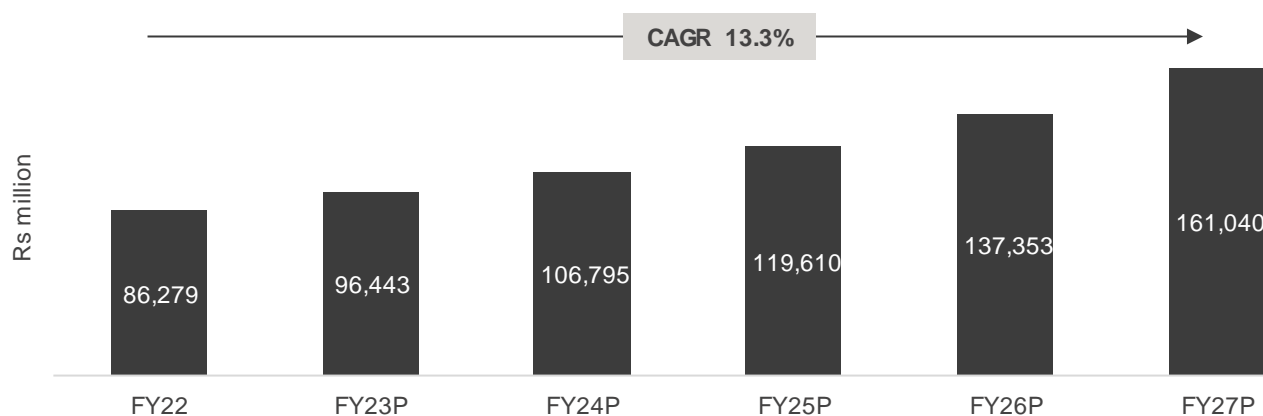
Products within every segment are listed below:

Sub-segment	Component
Engine parts	Crank case, crank case cover, cylinder block, throttle body, engine cover, filter housing
Body/chassis parts	Pillion grip, footrest assembly, wiper housing, speedometer cable housing, hub, handle holder
Transmission parts	Flange final driven
Electrical/electronic parts	ECU plate/ECU heat sink,
EV-specific parts	Battery housing, motor housing, wheel pulley and intermediate pulley

Products under every vehicle category are listed below:

Segment	Component	Market	Channel
Two-wheeler	<ul style="list-style-type: none"> Engine parts: Crank case, crank case cover, cylinder block, throttle body, engine cover Body/chassis parts: Pillion grip, footrest assembly, speedometer cable housing, hub Transmission parts: Flange final driven, Electrical/electronic parts: ECU plate/ECU heat sink, EV-specific parts: Battery housing, motor housing, wheel pulley and intermediate pulley 	Domestic	OE
PV	<ul style="list-style-type: none"> Engine parts: Throttle body, filter housing Body/chassis parts: Wiper housing Electrical/electronic parts: ECU plate/ECU heat sink, EV-specific parts: Battery housing, motor housing 	Domestic	OE
CV	<ul style="list-style-type: none"> Engine parts: Filter housing 	Domestic and export	OE

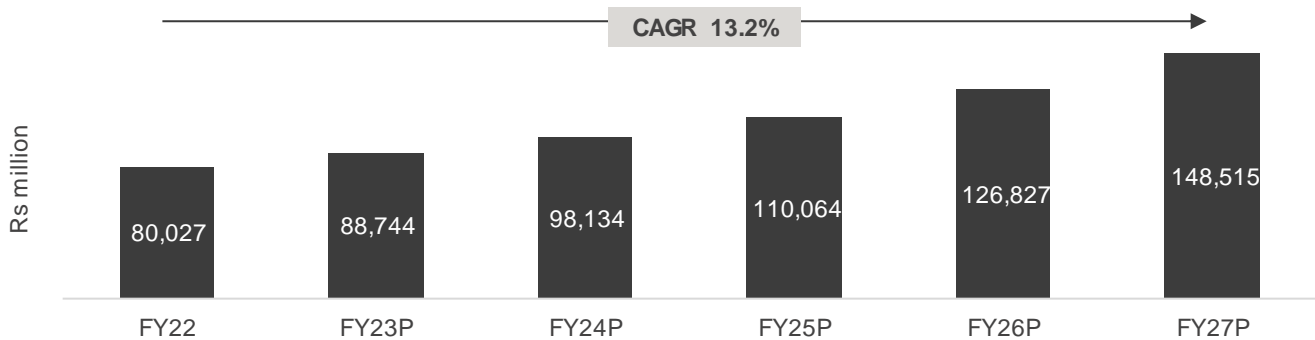
Aluminium lightweighting precision solutions market size (fiscals 2022-27P)



Source: CRISIL

Review of and outlook on aluminium lightweighting precision solutions in two-wheelers (fiscals 2022-27P)

Aluminium lightweighting precision solutions market size for two-wheelers (fiscals 2022-27P)

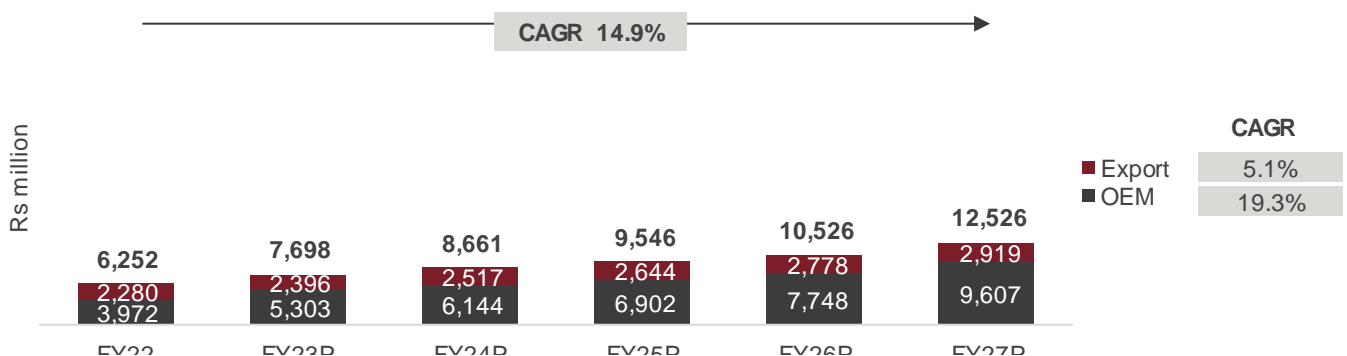


Source: CRISIL MI&A

The domestic market size of aluminium lightweighting precision solutions is estimated at Rs 80,027 million as of 2022 and is expected to grow at a 13.2% CAGR between 2022 and 2027 to Rs 148,515 million. The engine parts are the largest contributing category, followed by body/chassis parts based on the components considered. The market for electrical/electronic components and body/chassis parts is expected to grow; however, owing to the transition to EVs, the market for engine parts is expected to be negatively impacted and witness slow growth. Engine parts including crankcase, crankcase cover, cylinder component, throttle body, engine cover and hub wouldn't be a part of electric 2W's. However, new components like wheel pulley, battery housing, battery cover, motor housing, motor cover, gear housing and gear housing cover would be added to EV 2W's and could increase the overall aluminium content by 30-50% in terms of weight compared to an ICE 2W. However, due to the complexity and more number of parts, it could be more than double in value terms. Growth in the aluminium lightweighting precision solutions market for EVs will be primarily led by electrical/electronic parts, EV-specific components, and body/chassis parts. The aluminium content per vehicle is expected to increase with the penetration of EVs as big battery trays demands a good thermal conducting material alongside offering improved structural, crash, and lightweighting performance. Also, growing electrification of vehicles will increase the rate of use of electrical components and EV-specific components, propelling growth in aluminium lightweighting precision solutions in the segment.

Review of and outlook on aluminium lightweighting precision solutions in PVs and CVs (fiscals 2022-27P)

Aluminium lightweighting precision solutions market size for PVs and CVs (fiscals 2022-27P)



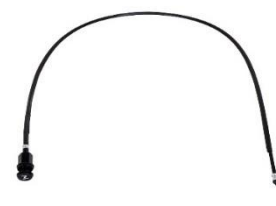
Source: CRISIL MI&A

The market size for aluminium lightweighting precision solutions is estimated at Rs 6,252 million in 2022 and is expected to grow at a 14.9% CAGR over the forecast period to Rs 12,526 by 2027. Based on the above segmentation, the market for lightweight solutions is primarily led by OEM-based components as OEMs are focusing on lightweighting to meet emission standards and improve safety in vehicles. In addition, with rising EV penetration, OEMs are trying to develop structural and body components that can lessen the body weight, reducing the load on the vehicle and thereby improving their range. Currently, the export market is very small; however, with the outlook on PV and CV export being positive, the market is expected to see robust growth.

Safety control cable solutions

Safety control cables (SCC) are very important parts in the automotive industry, used in motorcycles, scooters, mopeds, and 2W EVs to actuate, control and operate applications such as Brake, Accelerator, Clutch, Transmission Gear, Speedometer, Fuel Lid, Seat Lock, Choke, Battery Charging Lid. Throttle cables are used to accelerate the vehicles, brake cables are used to stop the vehicle, clutch cable is used to dis-engage & engage the power of engine, choke cable provided to enrich the fuel in cold conditions, seat cable is used to lock and unlock the seat, fuel lid cable can lock and unlock the lid of fuel and apply the combined brake on both front and rear brakes by combi brakes.

Choke cable: A choke cable controls air flow into the carburettor of an engine. It helps enrich the fuel-air mixture, enhancing an engine's ability to be started in low temperatures. The ratio of the air-fuel mixture required to start the engine changes with temperature, and for carburettor-fitted bikes, the choke cable ensures there is enough useable fuel to start the engine in low temperatures. **Two wheelers' chokes are a mandatory feature of all the two-wheelers.** The choke enriches the fuel mixture either by adding more fuel or cutting off air supply, thereby increasing the amount of combustible vapour available to start the engine. On a motorcycle, a choke valve is likely to be a pulling lever either directly or indirectly attached to the carburettor via a cable. The shape of the choke cables is like that of a butterfly. When it is pulled by the rider, it blocks the air passage from both sides by rotating.



Source: ASK Automotive

Clutch cable: A clutch cable forms an important part of a motorcycle's transmission. The clutch is the mechanism responsible for engaging and disengaging power from the engine crankshaft with gears. It is the component through which the rider's input passes to the clutch's internals. Simply, with clutch cable's help, the clutch connects the clutch lever with the engine responsible for shifting gears. It is made of braided steel and is held under tension between the clutch lever and a bracket by the engine and transmits force between the clutch lever (on the handle) and pressure plate. Pulling the clutch lever moves the cable and plate, disengaging the clutch's friction discs from the engine to shift transmission. This enables switching of gears and, consequently, managing speed.



Source: ASK Automotive

Brake cable: A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. A brake cable connects the brake handle, or pedal, to a vehicle's braking mechanism and is responsible for engaging and disengaging brakes in vehicles. Hence, it is very important for the smooth and accurate application of brakes. Brake cable wire impedes the vehicle's motion by arresting energy from its moving system. By means of friction, brakes slow or stop a moving vehicle, wheel, and axle or in all, stop or slow down the motion.



Source: ASK Automotive

Speedometer cable (speedo cable): A speedo cable reads a motorcycle's speed through a cable housing that is routed to the speedometer gauge. The cable rotates within the cable housing and calculates the speed of a bike, which is displayed in the gauge, either in mph or kph. The motorcycle's speed can be calculated using the number of rotations made by the wheel. Therefore, to calculate speed, the magnetic force of the magnet attached to the wheel near the sensor needs to be measured. The speedometer cable whirls the magnet. When the rider starts the engine, the driveshaft turns to make the wheel rotate. As a result, the bike's speedometer cable turns too, powered by the drive shaft.



Source: ASK Automotive

Throttle cable: Throttle cable connects the accelerator handle or lever to the throttle body allowing the driver to control vehicle's level of acceleration and speed. Throttle cables are a mechanical link between the accelerator handle, or the engine throttle body (located between the air filter box and the intake manifold). They help in managing the speed of the bike/scooter by releasing pressure on the accelerator pedal. When the driver pushes the handle up, the action opens the throttle which lets air and fuel enter the engine. More fuel and air enter the engine cylinders of bike/scooter, which produces more power, and the bike/scooter moves faster. By using throttle cable, which increases or decreases the engine's power. Bike/scooter accelerator cable gives the rider a smooth and friction-free riding experience. The inner part of these cables is made of stainless steel or galvanized, which provides strength and flexibility. Outer Part of these cables is made of High carbon steel, Liner and coated with high quality of PVC/PP, which provides strength as well as it provides sustainability in high and low temperature. The throttle cable connects the accelerator handle to the throttle body, allowing the driver to control the vehicle's level of acceleration. This requires the cable to be able to withstand prolonged period of use.



Source: ASK Automotive

Seat lock cable: A seat lock cable finds application in scooters and motorcycles, where a key mechanism is involved to release the scooter seat lock. It helps open the seat and facilitate the seat lock mechanism. The inner part of these cables is made of stainless steel or galvanized, which provides strength and flexibility. Outer Part of these cables is made of High carbon steel, Liner and coated with high quality of PVC/PP, which provides strength as well as it provides sustainability in high and low temperature.



Source: ASK Automotive

Fuel cable: The purpose of Fuel Lid cable, to unlock and lock the fuel lid in scooters. It operates by Key. It prevents to prevent the fuel from robbers. The inner part of these cables is made of stainless steel or galvanized, which provides strength and flexibility. Outer Part of these cables is made of High carbon steel, Liner and coated with high quality of PVC/PP, which provides strength as well as it provides sustainability in high and low temperature.



Source: ASK Automotive

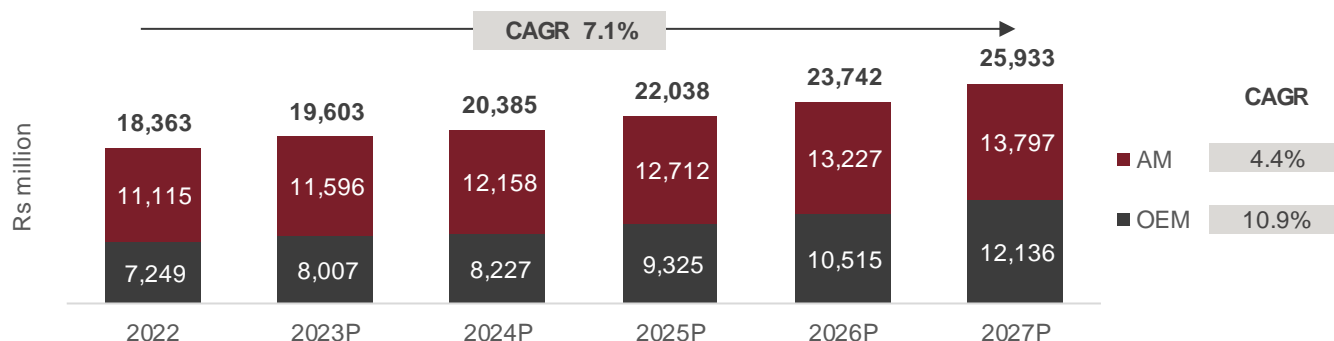
Review of and outlook on the safety control cables market (fiscals 2022-27P)

The safety control cable solutions market includes choke, clutch, brake (front and rear), speedo, throttle, seat lock, and fuel cables catering to the motorcycle, scooter, and EV segments in the two-wheeler industry. The usage of each of these cables is one unit per vehicle.

Cables applicable for every vehicle category, market, and channel are listed below:

Segment	Component	Market	Channel
Motorcycle	Choke cable, clutch cable, brake cable (front and rear), speedo cable, throttle cable	Domestic	OE and AM
Scooter	Choke cable, clutch cable, brake cable (front and rear), speedo cable, throttle cable, seat lock cable, fuel cable	Domestic	OE and AM
EV	Brake cable (front and rear), seat lock cable	Domestic	OE and AM

Safety control cables solutions market size (fiscals 2022-27P)



Note: AM includes OES, IAM and unbranded segments
Source: CRISIL

The market size for safety control cable solutions is calculated considering the usage of each of these cables in multiple vehicle segments. It is estimated at Rs 18,363 million in 2022 and is expected at Rs 25,933 million by 2027, growing at a CAGR of 7.1%. The aftermarket (AM) is largest market for this segment; however, the OEM segment is expected to grow at a higher CAGR. Moreover, with increasing EV penetration, the content of cables used in two wheelers for engine operations are declining. In this light the larger fleet of vehicles in the parc would be the key driver for the cables market in the medium to long term.

Suprajit Engineering Ltd, Ramson Industries, ASK Automotive, and Hi-LEX are leading players in the market. ASK Automotive is among the prominent players in the safety control cable segment in India, in terms of volume for 2W OEMs in fiscal 2022.

Total Addressable Market (TAM) by vehicle segment and component category (fiscals 2022, Rs Million)






Market Size (Rs Million) 2022	2W		3W		PV		CV		
	OEM	Replacement	OEM	Replacement	OEM	Replacement	OEM	Replacement	Export
Advanced Braking Systems									
Brake Panel Assembly	6,919	-	-	-	-	-	-	-	-
Brake Shoe	2,601	12,117	164	587	-	-	-	-	-
DBP	658	1,549	-	-	1,219	2,051	-	-	2,063

Mission Case	1,298	-	-	-	-	-	-	-	-
Brake Lining	-	-	-	-	-	-	3,107	-	21,478
Body (Modulator/Park Relay)	-	-	-	-	-	-	175	-	-
Total	11,476	13,666	164	587	1,219	2,051	3,282		23,541
Aluminium Lightweighting Precision Solutions									
Engine Parts	46,949	-	-	-	2,578	-	403	-	2,280
Body/Chassis	28,079	-	-	-	288	-	-	-	-
Transmission Parts	1,357	-	-	-	-	-	-	-	-
Electronics	3,034	-	-	-	614	-	-	-	-
EV Specific	608	-	-	-	88	-	-	-	-
Total	80,027				3,569		403		2,280
Safety Control Cable Solutions	7,249	11,387	-	-	-	-	-	-	-

Source: CRISIL

Transition mapping on ASK-specific automotive components

Segment	Category	Product	Vehicle Segment	
			ICE	EV (HEV, BEV)
Advanced Automotive Braking Solutions	Braking	Brake panel assembly, brake shoe, disc brake pad (DBP), brake lining, mission case	—	—
Aluminium Lightweighting Precision Solutions	EV Specific	Motor housing	—	↑↑↑
		Battery housing	—	↑↑↑
		Wheel pulley	—	↑↑↑
	Electrical/Electronics	ECU housing/ECU heat sink	—	↑↑↑
	Transmission parts	Flange final driven	—	↑
	Body/Chassis Parts	Pillion grip, footrest assembly, speedometer cable housing, wiper housing, hub	—	—
	Engine Parts	Crankcase, crankcase cover, filter housing, cylinder block, throttle body, engine cover	—	↓↓↓
Safety Control Cable Solutions	Cables	Choke cable, clutch cable, brake cable (front & rear), speedometer cable, throttle cable, seat lock cable, fuel cable	—	↓

 Improved realizations
  Significant improved realizations
  No transition impact
  Reduced realizations
  Significant reduced realizations

Source: CRISIL

Every segment within the automotive industry is embracing a transition towards electrification. Due to the different requirements of the EV market such as lightweight components, completely different powertrain, and new component segments such as high-power electronics and batteries, traditional ICE vehicle manufacturers are witnessing a transformation in the entire ecosystem in a short period. Companies that can transition to develop new products and cater to the segment stand to gain, whereas players who fail to keep up with demand from these transitions are at a risk of falling behind. Electrification has increased the content of electronics and associated components in vehicles. Since EVs have a different powertrain or propulsion technology, traditional ICE components including engine parts, the operating mechanism, and fuel systems are not present in EVs. These are replaced by EV-specific components such as batteries, motors, inverters, and their associated assemblies. Although ICEs and EVs are different in terms of operation, some components that are common to these include seating, braking, body parts, and cables.

The braking systems in the ICE vehicles and EVs are common and use similar components. Currently, EVs also use traditional braking components such as drum brake shoes and (DBPs) for braking. However, in future, with the rapidly evolving EV segment, the specifications of components could also change with longer-term trends such as the need for lighter and safer components.

Lightweighting has always been a point of focus for both ICE vehicle and EV manufacturers. Companies are using components made from aluminium, by improving the properties of these components to match application needs while keeping the weight low. With the dual focus on reducing oil imports, as well as gradually tightening fuel consumption, norms have forced OEMs to look for ways to improve fuel efficiency in their vehicles. One of these involves the use of components that have a higher strength-to-weight ratio, i.e., these components weigh less, but at the same time, offer superior structural properties and service life. Another area of focus is EVs, where efforts to alleviate range anxiety require more efficient vehicles that are lighter, but also strong enough to support heavier parts such as batteries, so that structural integrity is maintained on rough roads and in the case of a crash.

Safety control cable solutions are specific to the two-wheeler segment, and their intensity changes based on their class, i.e., motorcycle vs. scooters. Moreover, with the rise in electric two-wheelers, the market for some cable types such as clutch cable and choke might be negatively impacted, as these are not used in EVs. However, the sharp increase in EV penetration should offset the demand decline from the ICE segment to some extent.

Financial profiling of key automotive component players competing with ASK Automotive

Key player profiles

Key players in the braking solutions, aluminium lightweighting solutions and safety control cables market are ASK Automotive Ltd, Uno Minda Ltd, Endurance Technologies Ltd, Suprajit Engineering Ltd, and Bharat Forge Ltd.

ASK Automotive Ltd

Key facts	Brief profile
<p>Year of incorporation: 1988</p> <p>HQ: Gurgaon, Haryana</p>	<p>Key product segments</p> <p>The company manufactures automotive components for two-wheelers, three-wheelers, passenger vehicles (PVs) and commercial vehicles (CVs). Its key business segments are braking solutions, aluminium die casting and safety control cables.</p> <p>ASK designs and develops safety systems and critical engineering solutions for more than three decades and is the leading brand in the 2W independent aftermarket braking segment in terms of production volume for fiscal 2022. In the 2W segment, it has the leading market share in the advanced braking segment in terms of volume in fiscal 2022 and is one of the prominent players in the aluminium lightweighting precision solutions segment. It has over 400 dealers distributing its branded products in the aftermarket segment in India as of 31st March 2022. ASK competes directly and indirectly with other manufacturers and suppliers of safety systems and critical engineering solutions to OEMs and in the aftermarket.</p> <p>The company manufactures braking systems, such as brake shoes, disc brake pads, brake linings and brake assembly.</p> <p>ASK's safety control cables business makes a comprehensive range of control cables, including brake cable, throttle cable, trunk opener cable, brake cable, head lock control cable, clutch cable, choke cable, seat lock cable, gear lock cable and fuel lock cable.</p> <p>Its aluminium die casting business offers aluminium pressure die casting and machined components, such as brake panels, crank cases, hubs and other engine and body components.</p>
<p>Plant locations</p> <p>ASK has 16 manufacturing facilities in India. They are situated in Haryana, Uttarakhand, Karnataka, Himachal Pradesh, and Gujarat.</p>	
<p>Key clients</p> <p>Hero MotoCorp, TVS, Bajaj, Tata Motors, Maruti Suzuki, Honda Motorcycle & Scooter India, Yamaha, and Royal Enfield.</p>	

Uno Minda Ltd

Key facts	Brief profile
<p>Year of incorporation: 1992</p> <p>HQ: Gurgaon, Haryana</p>	<p>Key product segments</p> <p>The company specializes in the manufacture of auto components for global and domestic automotive market.</p> <p>It caters to two-wheelers, three-wheelers, PVs and offroad vehicles.</p> <p>It manufactures diverse parts and accessories for motor vehicles such as brakes, gearboxes, axles, road wheels, suspension shock absorbers, radiators, silencers, exhaust pipes, catalysers, clutches, steering wheels, steering columns, and steering boxes.</p>

Plant locations

Uno Minda has manufacturing facilities in India, Indonesia, Vietnam, Spain, and Mexico. Its R&D centers are in India, Germany, and Spain. It has more than 70 manufacturing plants globally and sales offices in North America, Europe, and the Association of Southeast Asian Nations (ASEAN) member countries.

Key clients

Toyota Kirloskar Motor, Hero MotoCorp, Piaggio Vehicles, TVS and Bajaj.

Endurance Technologies Ltd

Key facts	Brief profile
<p>Year of incorporation: 1990</p> <p>HQ: Aurangabad, Maharashtra</p>	<p>Key product segments</p> <p>The company is a leading manufacturer and supplier of aluminium die casting components (ADCC) for automobiles.</p> <p>Its business segment includes aluminium die casting, suspension, transmission, braking systems, and aftermarket.</p> <p>The company manufactures suspension, transmission, steering columns, clutches, catalysers, silencers, and braking products, which are supplied to two- and three-wheeler OEMs.</p>

Plant locations

The company has manufacturing presence in India, Germany and Italy and has more than 25 plants. Its overseas operations are primarily through two direct subsidiaries, Endurance Aman n GmbH (Germany) and Endurance Overseas Srl (Italy). They supply casting and machining products to leading four-wheeler OEMs in Europe.

Key clients

Kia Motors India, Honda Motorcycle & Scooter India, and Royal Enfield.

Suprajit Engineering Ltd

Key facts	Brief profile
<p>Year of incorporation: 1985</p> <p>HQ: Bangalore, Karnataka</p>	<p>Key product segments</p> <p>The company manufactures mechanical control cables used in the automotive (two-wheelers and four-wheelers) and non-automotive segments, and equipment such as speedometers, tachometers and fuel and temperature gauges for the automotive sector.</p> <p>It also produces halogen lamps for the automobile industry and is a dominant player, catering to the two- and four-wheelers in the PV, CV, and after-market segments.</p>

Plant locations

In India, it has 18 manufacturing facilities located in states including Karnataka, Haryana, Maharashtra, Gujarat, Rajasthan, Tamil Nadu, and Uttar Pradesh. Globally, it has manufacturing facilities in the USA, the UK, Germany, Mexico, and Luxembourg.

Key clients

Tata Motors, TVS, Hero MotoCorp, Bajaj, Yamaha, Volkswagen, Mahindra & Mahindra, Jaguar Land Rover, Piaggio, Nissan and Eicher Motors.

Bharat Forge Ltd

Key facts	Brief profile
<p>Year of incorporation: 1961</p> <p>HQ: Pune, Maharashtra</p>	<p>Key product segments</p> <p>The company is involved in metal forming and serves industrial and automotive business. Industrial business segment includes power, oil and gas, construction & mining, rail, marine and aerospace sector. Within automotive business, the company serves PV and CV segment.</p> <p>Key business segments include forging and others. The forging segment includes manufacture of forged products comprising forging and machined components for automotive and industrial sector. Others includes various new initiatives which the company is carrying out other than forging related activities.</p> <p>The company manufactures brakes, Gearboxes, Axles, Road Wheels, Suspension Shock Absorbers, Radiators, Silencers, Exhaust Pipes, Catalysers, Clutches, Steering Wheels, Steering Columns and Steering Boxes.</p>
<p>Plant locations</p> <p>It has 15 manufacturing plants spread across India, Europe, and North America with eight, five and two manufacturing plants in each region.</p> <p>Key clients</p> <p>The company's customer base includes virtually every global automotive OEM and Tier-1 supplier. John Deere, Ashok Leyland, Caterpillar, and DAF Trucks among others.</p>	

Annexure I: Peer comparison

Notes:

- All figures are in Rs million, unless stated otherwise
- All figures are consolidated financials
- All companies and their subsidiaries mentioned in the comparison may not be engaged in similar lines of business and hence, a direct comparison in terms of financial competitiveness may not be prudent

Peer Comparison FY23 financials

Particulars	ASK Auto	Uno Minda Limited	Endurance Technologies Limited	Suprajit Engineering Limited	Bharat Forge Limited
Revenue from Operations	25,551.67	112,364.90	88,040.46	27,523.55	129,102.59
Revenue Growth Rate	26.93%	35.17%	16.62%	49.55%	23.41%
EBITDA	2,475.45	12,908.70	10,816.93	3,512.66	19,403.80
EBITDA Margin (%)	9.65%	11.44%	12.22%	12.59%	14.83%
Profit after tax for the year ("PAT")	1,229.53	7,002.30	4,795.75	1,521.09	5,083.87
PAT Margin (%)	4.79%	6.20%	5.42%	5.45%	3.89%
Return on average equity (RoAE) (%)	19.27%	18.99%	13.92%	14.54%	6.56%
Return on Average Capital Employed (RoACE) (%)	22.06%	17.91%	14.61%	18.74%	12.75%
Average Debt to EBITDA ratio	0.97	0.80	0.41	1.36	3.22
Debt to Equity Ratio (Gearing Ratio)	0.49	0.28	0.11	0.52	1.02
Cash Flow to EBITDA Ratio	55.98%	61.84%	79.69%	68.06%	9.87%
Asset Turnover Ratio	2.14	1.48	1.39	1.32	0.76
Working Capital Days	27.74	43.99	23.09	86.35	114.85

Note:

Revenue from Operations: Revenue from Operations means the Revenue from Operations as appearing in our Restated Financial Statements.

Revenue Growth Rate: Revenue Growth (%) is calculated as Revenue from operations for the current year minus Revenue from operations for the previous year as a % of Revenue from operations for the previous year.

EBITDA: EBITDA is calculated as profit before share of net profits/losses of joint venture, exceptional items and tax plus finance costs plus depreciation and amortisation expense.

EBITDA Margin (%): EBITDA Margin (%) is the percentage of EBITDA divided by total income.

Profit after tax for the year (PAT): Profit after tax for the year as appearing in our Restated Financial Statements.

PAT Margin (%): PAT Margin (%) is calculated as Profit after tax for the year as a % of Total Income.

Return on average equity (RoAE) (%): RoAE is calculated as Total Comprehensive Income for the year divided by Average Equity for the year. Average Equity is calculated as average of the total equity at the beginning of the year and at the end of the year. Total Equity is calculated as equity share capital plus other equity plus non-controlling interest.

Return on Average Capital Employed (RoACE) (%): RoACE is calculated as Earnings before interest and taxes (EBIT) excluding other income divided by Average Capital Employed. EBIT is calculated as EBITDA minus Depreciation. Average Capital Employed is calculated as average of the capital employed at the beginning of the year and at the end of the year. Capital Employed is computed as Total Equity (equity share capital plus other equity plus non-controlling interest) plus total non-current liabilities except non-current lease liabilities.

Average Debt to EBITDA ratio: Average Debt to EBITDA ratio is calculated as Average debt divided by EBITDA. Average Debt is calculated as average of the debt at the beginning of the year and at the end of the year. Debt refers to Total Borrowings (non-current and current).

Debt to Equity Ratio (Gearing Ratio): Debt to Equity Ratio (Gearing Ratio) calculated as Closing Debt (current and non-current borrowings) divided by Total Equity.

Cash Flow to EBITDA Ratio: Cash Flow to EBITDA Ratio is calculated as net cash flow from operating activities divided by EBITDA

Asset Turnover Ratio: Asset Turnover Ratio is calculated by dividing Revenue from operations for the year by the average total assets. Average total assets is calculated as average of total assets at the beginning of the year and at the end of the year.

Working Capital Days: Working capital days is computed as Inventory days plus Trade receivable days minus Trade payable days.

a. Inventory days is calculated as Inventory divided by revenue from operations multiplied by 365 days.

b. Trade receivable days is calculated as Trade receivable divided by revenue from operations multiplied by 365 days.

c. Trade payable days is calculated as Trade payable divided by revenue from operations multiplied by 365 days.

Source: RoC, Annual reports

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