



cutting through complexity



KPMG IN INDIA AND ACMA INITIATIVE

Emerging trends and technologies in the automotive sector

Supply chain challenges and opportunities

Prepared for ACMA's National Conference on driving affordable and accessible technology innovations.
The sustain logo belongs to ACMA's Sustainable Technology Development Committee.

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1 Message from KPMG

The automotive industry is a significant contributor to India's GDP. Though the industry has been witnessing subdued growth, the long-term outlook for the sector remains positive. India has become a coveted market not only for global vehicle manufacturers but also for component suppliers. Many vehicle manufacturers today consider India as a key part of their global strategy. Interestingly, this potential is not limited only to the domestic market. Automotive companies, both Indian and international, OEMs or component suppliers alike, have made their presence felt on the global stage. India exported ~2.5 million vehicles in 2014-15. The potential is immense and growth opportunities abound. However, to realise its potential, the industry has to be mindful of the challenges that the global automotive sector is facing and adapt to the changing dynamic environment.

Stringent emission and safety norms are playing an increasingly important role globally. In the recent past, the government has focussed on tighter emission norms to regulate air pollutants from vehicles and is promoting green vehicles. Of late, safety has also been attracting governmental attention. Evolving technologies and trends in connectivity, lightweighting, electronics, etc. have only added to these complexities.

Automotive supply chains may have to deal with the complexities that arise out of these changes. Vehicle manufacturers, along with their suppliers, need to evaluate ways to address these issues and develop technologies which are affordable and accessible.

This report provides deeper insight on these trends that are shaping the market and the challenges they pose to the Indian automotive industry. It also outlines the current state of the industry and indicates the way forward as well as the opportunities that could exist for suppliers in the near future.



Rajeev Singh
Partner and Head
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KPMG in India

2 Message from ACMA

The Automotive Component Manufacturers Association of India (ACMA) is the apex body furthering the cause of the manufacturers of automotive parts and accessories in India and simultaneously, been the bedrock that has enabled the Indian automobile industry to take giant strides in producing vehicles of international repute.

Today the turnover of the auto component industry is INR2340 billion (USD38.5 billion) for the period April 2014 to March 2015, registering a growth of 11 per cent over the previous year and a Compounded Annual Growth Rate (CAGR) of 11 per cent over the last six years. The auto component industry in India is expected to scale up to INR6347 billion (USD100 billion) in turnover by 2020 with exports to grow in the range of INR2221-2539 billion (USD35-40 billion).

To keep up this growth the industry has to overcome challenges in technology, high cost of capital, capacity utilisation, infrastructure, input costs, government policies and human capital. A focus is also required on investments in technology and collaboration with the supply chain, apart from other factors.

One of the major challenges for the industry is to build R&D competence and an ecosystem. Therefore, ACMA has been engaged with Fraunhofer, MIT, CMERI and other research institutes. Government is now encouraging R&D by giving a 15 per cent reduction of rate of income tax on royalty and fees for technical services. Now is the time to invest in technology.

The higher level involvement by industry players in electronics, safety, making key functionalities accessible and reduction in development and production costs will make technology more affordable over a period of time.

In this connection ACMA STDC (Sustainable Technology Development Committee) took the initiative through this conference to provide an industry perspective on emerging affordable and accessible technologies in the automotive sector. It will cover lightweighting, electrification of powertrains and improving the safety and fuel efficiency of vehicles. It will also touch upon how connectivity and electronics will emerge as differentiators in new age vehicles. In addition, it will involve discussions on the impact of the technology and regulatory developments on emerging business models of vehicle manufacturers and auto component manufacturers.



Vinnie Mehta
Director General
ACMA

3 Executive summary

Global automotive Original Equipment Manufacturers (OEMs) and suppliers recognise India as a key market today. The sector is witnessing significant changes in line with the global industry. Fuel efficiency (lowering the cost of operating a vehicle) has always been a key factor for Indian customers. However, of late, emissions and safety have also assumed greater importance, in line with global trends. The Indian government is considering bringing in stringent safety, emissions and fuel efficiency related regulations.

Automotive OEMs have been working on various technologies such as lightweighting, electrification of powertrains and safety features (Anti-lock Braking System (ABS), Electronic Brakeforce Distribution (EBD) etc.). These are increasingly finding their way into Indian vehicles as well. While these developments do pose a host of challenges, they also open a lot of interesting opportunities for the Indian automotive sector.

On electrification of powertrain, lack of volumes and technology advancements have left the Indian electric vehicle industry lagging behind China, the United States, Japan, etc. While the National Electric Mobility Mission Plan (NEMMP) 2020 was launched by

the government to provide demand side incentives with an R&D focus, Faster Adoption and Manufacturing of (Hybrid and) Electric vehicles (FAME India) to increase the adoption of electric and hybrid vehicles in India. These moves are a positive sign for an industry that is still in its nascent stage with an underdeveloped supply chain.

Lightweighting is another area where limited progress has been made by the Indian automotive companies. While Tier 1 suppliers have been working closely with OEMs on this, the challenge is to bring this capability to Tier 2 and 3 levels as well.

Telematics in India is in its early stages of growth. The segment is closely followed by the development in electronics and advancement in communication technology. The infotainment segment is largely based on consumer lifestyle. Prominence of IT industry in the country is a boon to the telematics industry. Growing demand in telematics and infotainment has resulted in the need of having a well-defined telematics supply chain supported by adequate infrastructure for it to be widely accepted and adopted.

The penetration of electronics in the automotive industry is increasing significantly. Considering the growing importance of electronics in cars, developing less expensive electronics architecture may expedite the demand for electronics and enable sophisticated functionalities. Indian software firms, can play a pivotal role by forming effective partnerships with industry stakeholders to create a mark here.

The paper discusses these emerging trends in the automotive industry with specific relevance to India and evaluates the impact of these trends on the automotive supply chain. It concludes with a view on the existing supply chain precision and the way forward.

4 Indian automotive industry

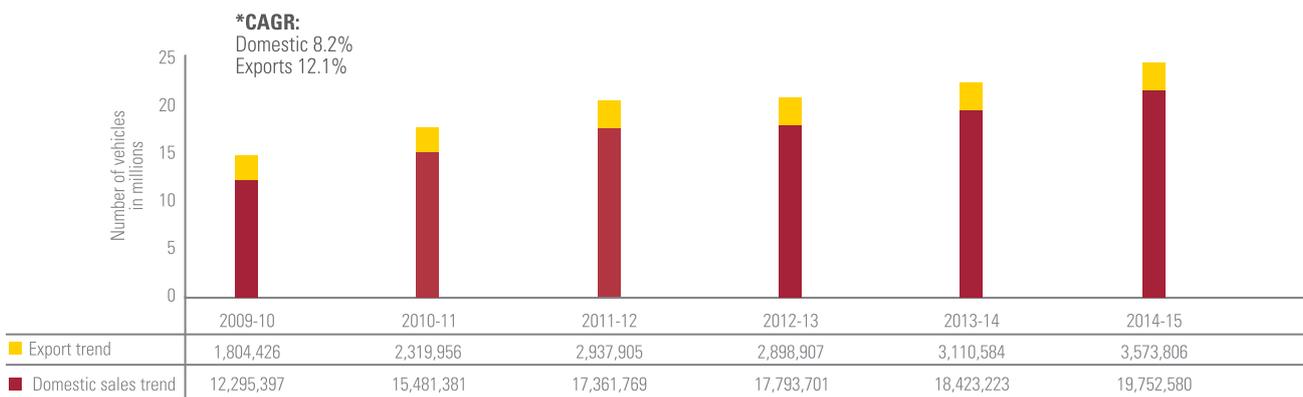
Introduction

The Indian automotive industry has seen significant evolution in the last three to four decades. In the 1970's, India was a closed market with a restrictive regulatory environment and growth was limited by supply, outdated auto models, high duties and sales taxes. Post liberalisation,

the automotive sector was de-licenced with automatic approval for Foreign Direct Investment (FDI) up to 100 per cent equity. This period also saw an entry of the key automotive OEMs and suppliers into the Indian market through organic or inorganic routes.

Today, Indian consumers have a gust of choices and automotive companies are designing vehicles from ground up and taking them to other markets.

Domestic and export trend, 2009-10 to 2014-15



Source: Society of Indian Automobile Manufacturers and *KPMG in India analysis, 2015 (Calculated values)

The automotive industry today contributes approximately 22 per cent to the country's manufacturing Gross Domestic Product (GDP)¹. In recent years, India has witnessed increasing investments in R&D and geographic expansion from global automotive manufacturers. Considering the automotive industry ranked sixth in attracting FDI equity, with a cumulative inflow of approximately INR681 billion from April 2000 - April 2015²,

successful formulation and changes in policies have also been made by the government to support the industry.

In 2014-15, the industry registered a growth of 8.68 per cent over the same period last year by producing 23 million vehicles³. While the domestic sales of passenger vehicles, three-wheeler and two-wheeler in April 2014 grew, commercial vehicles registered

a negative growth, which was credited to muted economic activity. Exports across almost all vehicle segments showed a positive growth during the same period.

1. http://indiainbusiness.nic.in/newdesign/index.php?param=industryservices_landing/329/1

2. Factsheet on Foreign Direct Investment (FDI), accessed April 2015

3. <http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=9>

While the Indian automotive industry continues to evolve with increasing customer expectations from products, price sensitivity, shorter product life cycles, frequent change in product ownership and focus on safety and entertainment features, the industry is also witnessing significant regulatory challenges.

Substantial growth in the automotive industry is expected to provide several opportunities in both rural and urban markets to industry participants, since the Indian industry has robust domestic sales in key segments. Emerging preference for SUVs and MPVs is likely to drive the introduction of new models. Commercial Vehicles is expected to grow this year on account of improved economy performance. While two wheelers will continue to remain the mainstay of the industry accounting for almost 70-75 per cent of the automotive industry volumes. While two wheelers will continue to remain mainstay of the industry accounting for 75 per cent of the industry volume⁴. However, the industry ecosystem faces several roadblocks such as land acquisition procedures, tax complexity, infrastructure constraints, changing emission and safety norms, etc. On the other hand, its demand-side faces challenges on price sensitivity and introduction of increasing number of vehicle models and variants, which has made India a tough market to compete. This fierce competition has impacted the supply side by increasing the pressure on costs.

There are high product design and modification costs involved in the supply side as well, which is influencing the supply chain. Lack of flexibility in the dynamic demand situation, capacity crunch, new business models and viability of channel partners are few other issues that have affected the supply chain.

Despite various challenges, the industry offers opportunities across existing conventional Internal Combustion Engines (ICE) and emerging alternate fuel segments. In ICE, the increasing use of lightweighting alloy components can provide opportunities for small complex casting and forging components. While in the alternate fuel segment, the government's stress on electrification of vehicles is expected to open doors for battery management systems, motors, controllers, etc.; component suppliers may benefit from vehicle manufacturers and the government's focus on making vehicles fuel-efficient. These opportunities rest on the backbone of technology innovation.

As India establishes itself as a manufacturing hub, OEMs are setting up production facilities with significant localisation. Industry participants have set product development and engineering centres in India, which source modelling and simulation expertise, low-cost vehicles that are for global markets, IT applications for future smart automobiles and monetise low-cost product development and frugal engineering approach.

4. <http://www.investindia.gov.in/automobile-sector/>



5 Regulatory landscape

With rising number of road fatalities, alarmingly high pollution levels, a ballooning oil import bill as well as the need to reduce dependence on fossil fuels, the government has been active in designing policies to address these issues. The evolving regulatory landscape makes it necessary for automakers to be cognisant of the new rules that would govern the industry and take appropriate steps to keep themselves ready in order to stay ahead.

Safety

According to a UN report, there are more than 200,000 road accident fatalities in India every year⁵. To address this, the government has been taking steps to review safety regulations. The centre also constituted a committee on road safety and traffic management in 2005 and approved the National Road Safety Policy in 2010 to take concrete measures.

Several developed countries have regulations for mandatory recall of vehicles if defects are found and reported by the customers. Currently, vehicle manufacturers in India make voluntary recalls. These, recalls are a huge financial burden for the automakers. The new Road Transport and Safety Bill, highlights that if 100 or more people complain about a particular defect in a vehicle that could cause harm to occupants or other road users - to the Vehicle

Regulation and Safety Authority, then the authority can order a recall.

Another initiative by the Indian government to improve road safety is the plan to launch the Bharat New Vehicle Safety Assessment Programme (BNVSAP). It is an Indian version of the global New Car Assessment Programme (NCAP) wherein cars would receive star ratings based on safety features. The programme would include frontal and rear crash tests and require compulsory safety features like ABS and airbags. BNVSAP is likely to be mandated for all cars manufactured from 2017 while the existing models would have time till 2018.

In commercial vehicles, ABS is mandatory for all new models launched after April 1, 2015 whereas manufacturers would get grace time till October 2015 to incorporate ABS in the new vehicles sold under existing models. On the other hand, the government has plans to make ABS mandatory for two-wheelers with engine capacity of 125 cc and above but time lines have not been decided upon.

Also, the government in November 2014, announced its plans to make airbags mandatory for passenger vehicles by October 2015. However, no timeframe has been rolled out for mandatory airbags in commercial vehicles.

Some global automakers in India have started offering safety features in several of their models to safeguard their brand image, retain customer confidence and to be prepared for the upcoming safety regulations. For instance, a leading automaker now provides dual airbags, while another provides airbags as well as ABS in all its models. To gain acceptance of customers with lower awareness of safety related features, these OEMs have also been using their dealerships to educate customers about the benefits of such features.

Many automakers in India that do not provide these safety features, recently failed crash tests which has raised serious concerns about a large majority of cars that ply on Indian roads. They argue that while safety features are introduced in their higher-end variants, it does not make business sense to have these fittings in their smaller entry-level cars as these product categories serve a highly price-sensitive customer segment.

Some automakers have started working behind the scenes to prepare themselves for the BNVSAP. By working closely with their suppliers, they are developing affordable safety features for the Indian audience to maintain their competitive position.

5. http://www.who.int/violence_injury_prevention/road_traffic/countrywork/ind/en/

Emissions

The Indian government has been taking steps, such as launching of an air quality index for several cities for real-time monitoring and to create awareness about pollution⁶.

Currently, the Bharat stage III emission standard is mandated throughout the country to regulate air pollutants. However, the Bharat stage IV standard, that is active in select cities, has resulted in vehicle manufacturers investing in new engine technologies and upgrades. Future standards such as Bharat stage V and VI are likely to be mandated in the near future⁷.

The issue of auto emissions and overdependence on fossil fuels is also being tackled through India's policies related to fuel efficiency of vehicles. The Bureau of Energy Efficiency (BEE) has already notified new norms under the Corporate Average Fuel Consumption (CAFC) policy, which when implemented would mandate a mileage increase of about 14 per cent for all passenger vehicles from 2016-17⁸. It would also require labelling of all new cars, wherein information of fuel consumption relative to other models in the same weight class would be provided. This would help customers make a more informed choice which could cause a pull for low-fuel consuming models. Customer preferences in India have always been in favour of better fuel economy vehicles due to lower operating costs and this has been a key reason of success for market leaders in passenger vehicles.



6. <http://www.bbc.com/news/world-asia-india-32193742>

7. <http://economictimes.indiatimes.com/industry/auto/news/policy/government-may-skip-a-stage-in-emission-norms-to-adopt-bs-vi-standards/articleshow/46016203.cms>

8. http://articles.economictimes.indiatimes.com/2014-02-14/news/47336604_1_new-norms-fuel-efficiency-passenger-vehicles

6 Technologies and trends that could drive the industry

Lightweighting

As the weight of a vehicle directly impacts its dynamics, agility, fuel consumption and CO₂ emissions, it has been drawing the attention of the automotive industry for decades now.

Lightweighting strategies today are a combination of component design, manufacturing process innovation and substitution of materials.

Leading car manufacturers in India have been targeting lightweighting with materials such as aluminium, magnesium alloy, high performance engineering plastics and high strength steel.

Vehicle manufacturers have to align

with Tier I and II suppliers to achieve the desired results. The automotive industry is looking at other sectors as well to quicken its own learnings in material science. One such sector is aviation and aerospace. Cross industry exchange from aviation to the automotive industry could increase the pace of adoption of advanced materials. A faster learning curve could be possible if knowledge of composite design, crash simulation, recyclability, material failure mechanism and assembly technologies is transferred from the aviation to the automotive industry.

In India, lightweighting is lagging behind in terms of global practices as the ecosystem is still in its nascent stage due to lack of technological innovation and inadequate investments in R&D. Some major challenges in lightweighting include high cost of materials, varied material properties, processing of raw materials, moulding, manufacturing, etc. Other challenges include ability to sustain low vehicle repair costs, infrastructure and skill development of technicians for handling multi-material joints, and full vehicle life cycle assessments to gauge the benefits of lightweighting material.

Material used	Advantages	Challenges
High strength steel (engine bodyworks)	Makes use of existing vehicle manufacturing infra	<ul style="list-style-type: none"> Comparatively lower strength to weight ratio
Aluminium (engines)	Easy to form and recycle	<ul style="list-style-type: none"> Harder to spot-weld Uses labour intensive adhesive bonding
Magnesium alloy (transfer casing, car seat frame, steering column, steering wheel core)	Low density and good strength to weight ratio	<ul style="list-style-type: none"> Low-high temperature strength Poor corrosion resistance
Glass fibre reinforced composites (suspension springs, sub-assemblies of pedals and mechanical linkages)	Parts can be consolidated so that less assembly time is required	<ul style="list-style-type: none"> Long production time Cannot be recycled
Carbon fibre reinforced composites (vehicle body and body parts)	Highest strength to weight ratio	<ul style="list-style-type: none"> Very high cost of carbon fibres

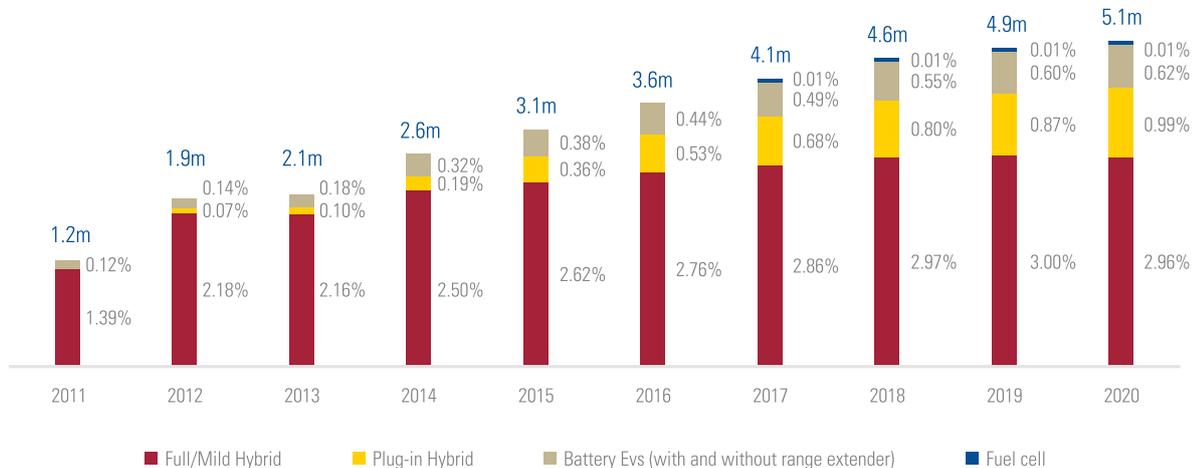
Source: Automotive Research Association of India and KPMG in India analysis, 2015

Electrification of powertrain

Apart from conventional vehicles, there are a variety of alternative fuel based vehicles on the road, such as CNG, LPG, electric vehicles, etc. Of all the alternatives available, Electric Vehicles (EVs) have been on the radar of the government and OEMs, globally. However, the scenario of roads filled with electrically operated cars still seems distant. According to the 2015 Global Automotive Executive Survey done by KPMG International, by

2020, less than one in 20 vehicles is expected to be equipped with electrified powertrains, which may be dominated by full or partial hybrids. The plug-in hybrid and battery EVs are expected to capture a smaller portion of the pie, followed by fuel cell electric cars that have the least share. By 2020, only 0.01 per cent of cars are expected to be equipped with fuel cells i.e. about 16,000 units per annum.

Global electrified powertrain production trend: 2011-2020



Source: KPMG's Competence Centre Automotive, LMC Automotive

Note: % - share of overall powertrain production volume in respective year; in million units

Though the traditional automotive (ICE) has registered growth, the EV industry continues to experience a growth struggle. EV sales and the number of electric two-wheeler manufacturers have dropped significantly in the last three years. However, the government is putting in efforts to boost the electric vehicles segment through reforms.

The number of electric vehicles sold each year globally is growing rapidly from 45,000 units in 2011 to more than 300,000 units in 2014⁹. The global electric vehicle cumulative registrations grew at a CAGR of 92 per cent to reach a total of 665,000 electric cars on road, by 2014. The United States of America held the largest share, with the world's biggest fleet of e-vehicles, followed by Japan and China¹⁰.

9. <http://www.smev.in/industry-info/ev-industry-overview/>

10. Global EV Outlook 2015, Clean Energy Ministerial's Electric Vehicles Initiative

Global electric cars cumulative registration as on 2014

Number of Electric cars



Source: Global EV Outlook 2015, Clean Energy Ministerial's Electric Vehicles Initiative

Globally, 320,000 electric cars were registered last year, of which 117,000 cars were registered in the United States followed by China at 54,000¹¹. China is one of the fastest growing markets for EVs, with 230 million e-bikes, 83,000 electric cars, and 36,500 e-buses on road by 2014¹².

China has also been focussing on New Energy Vehicles (NEV) for the last couple of decades, but could not get a foothold in the market. However, since 2013, the Chinese government has aggressively worked to flourish the local EV industry by subsidising the production and sale of NEVs. This step has led to a huge jump in its sales, with 74,800 units being sold in 2014, which is an increase of 325 per cent as compared to the previous year¹³. The government has also focussed on developing charging infrastructure by opening the country's distributed power grid and electric vehicle charging equipment markets to private

investors and subsidising the construction, operation, and upgrading of charging stations. All these efforts are expected to make China one of the largest markets for e-mobility by 2020.

However, the EV industry in India is far behind, with less than 1 per cent of the total vehicle sales. Currently, Indian roads are dominated by conventional vehicles (ICE) and have approximately 0.4 million electric two-wheelers and a few thousand electric cars only¹⁴. The Indian EV industry has been on the back seat due to various challenges that are similar to the global EV industry. High cost of batteries and cars has been a major obstacle to the widespread consumer adoption of EVs in India. Lack of inexpensive and robust charging infrastructure is another parameter which has hindered its growth.

Despite achieving more fuel savings in an electric car as compared to conventional cars, an EV owner

cannot recover the high cost of vehicle, which leads to high cost of ownership. A typical electric car in India costs around INR0.5 to 0.6 million which is approximately 2.5 times higher than an entry level fuel efficient conventional car. Also the battery life of the EV is approximately four to five years and the replacement cost is around INR0.2 to 0.3 million, which further adds to the cost of ownership¹⁵. Besides price, another barrier that has prevented the widespread adoption of EVs is range anxiety.

A weak supply chain is another specific challenge for the Indian EV industry, with limited domestic EV manufacturers and a small base of component suppliers. Presently, India has only one OEM that produces four-wheeler electric cars, while some of the other OEMs have been showcasing their electric car models at various events, but have not launched them commercially.

11. <http://www.zsw-bw.de/uploads/media/pi06-2015-ZSW-E-Mobility.pdf>

12. Global EV Outlook 2015, Clean Energy Ministerial's Electric Vehicles Initiative

13. <http://www.chinabusinessreview.com/opportunities-and-challenges-in-chinas-electric-vehicle-market/>

14. <http://www.smev.in/industry-info/ev-industry-overview/>

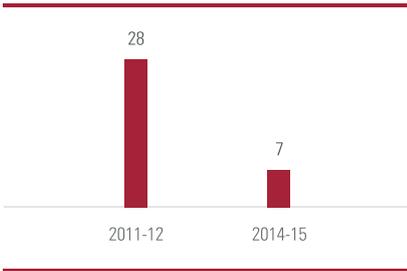
15. <http://forbesindia.com/blog/business-strategy/why-the-economics-of-mahindra-reva-e20-dont-work/>

Other manufacturers also cater to two and three-wheeler EVs in the market. India lacks technological innovation in the EV space, which is the reason for increasing imports.

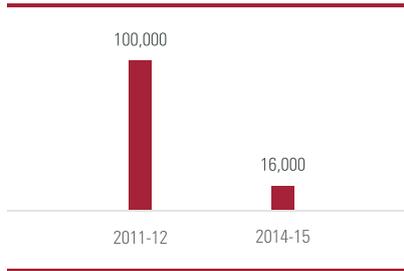
March 2012 has drastically affected the Indian EV industry¹⁶ as the sales and number of electric two-wheeler makers in India has dropped significantly in the last three years.

This burden of challenges and the withdrawal of various subsidies provided by the government in

Number of electric two-wheeler makers in India



Total electric vehicles sold in India

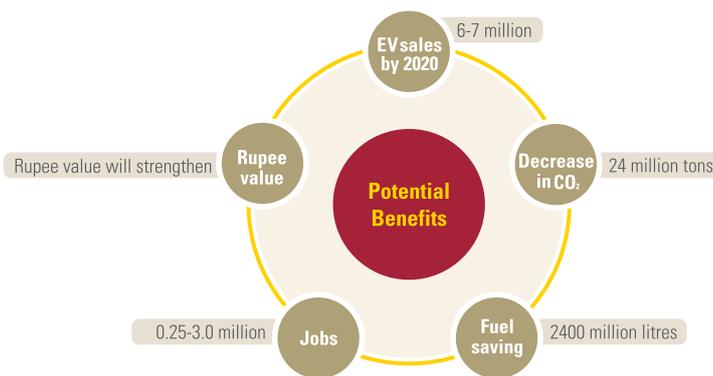


Source : Electric Vehicles in India Policies, Opportunities and Current Scenario, National Institute, National Institute of Urban Affairs scenario

Government initiatives in the EV space

With a target of deploying six to seven million electric vehicles in the country by 2020, under the NEMMP scheme, the government has emphasised on providing demand-side incentives along with R&D

focus. Developing a robust charging infrastructure is an important parameter to be addressed to create a conducive environment for mass adoption of EVs. If executed as per plan, the scheme may lead to the following outcomes:



Source : Ministry of Heavy Industries & Public Enterprises. Infograph : KPMG in India analysis, 2015

16. http://www.business-standard.com/article/companies/subsidy-withdrawal-hits-sales-of-electric-vehicles-112061800043_1.html

The launch of FAME was yet another major move by the government to encourage sales of electric and hybrid vehicles in India. The scheme, formulated as part of NEMMP 2020, was rolled out by the Ministry of Heavy Industries and Public

Enterprises, in collaboration with the Society of Indian Automobile Manufacturers (SIAM). Under this scheme, the government will provide demand-side incentives up to INR0.14 million for every electric car sold¹⁷. With a planned

investment of INR7,950 million, phase I of the scheme started from April 1, 2015 and will run till the end of 2016-17. The break-up of the fund allocation in 2015-16 and 2016-17 is as follows:

Particulars	2015-16 (INR million)	2016-17 (INR million)
Technology platform (+ testing infra)	700	1200
Demand infrastructure	1550	3400
Charging infrastructure	100	200
Pilot projects	200	500
IEC/Operations	50	50
Total	2600	5350
Grand total	7950 million	

Source : Electric Vehicles in India Policies, Opportunities and Current Scenario, National Institute, National Institute of Urban Affairs scenario

The incentive scheme is expected to give an impetus to the Indian EV industry by overcoming challenges related to the high cost of vehicles. However, to be successful in long run, there is a need for technological breakthroughs related to charging and range of batteries.

Key developments

Global OEMs, apart from supplying EVs, have also embarked on various innovative business models to enhance their service offerings and differentiate themselves from competitors. Some of the business models are:

- **Forward integrated OEMs:** Some of these have started focussing on developing

charging infrastructure by installing exclusive charging stations at various places, which are compatible only with the company models. For instance, a U.S. based OEM has installed superchargers at strategic locations in various cities in the country which can recharge the EVs manufactured by it.

- **Battery leasing:** Some of the OEMs have come up with an option of battery leasing, to reduce the barrier of higher price of EVs for potential buyers. For instance, an Indian manufacturer of electric cars provides a battery leasing facility, that has reduced the price of the car to around INR170,000¹⁸.

- **Smartphone application to locate charging station:** Companies have also come up with smartphone applications that help drivers in locating the nearest charging station that is compatible with the vehicle. For instance, an OEM provides an application which helps to locate the nearest charging station of different providers. This application is displayed in the navigation system of the car.

17. <http://trak.in/tags/business/2015/04/09/7m-electric-vehicles-2020-incentives-offered/>

18. <http://www.autocarpro.in/news-national/mahindra-reva-slashes-e2o-price-rs-177-lakh-8248>

Going forward

In India, the penetration of EVs in urban areas depends on the acquisition and ownership costs as well as quality of and accessibility to charging infrastructure. The government should work towards developing an environment that encourages the private sector to create charging infrastructure in the country. Another important focus, to boost the EV market, should be on batteries that typically constitute up to half of the vehicle cost and weight. The government should support research activities to develop innovative and low-cost batteries, recycling and reuse of batteries, etc. The NEMMP, focusses on battery cells and Battery Management System (BMS) technology as a priority.

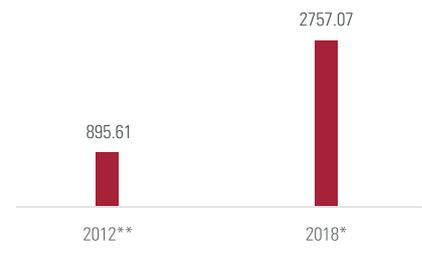
Hence, a lot needs to be done by both the government and OEMs to revive and rebuild the Indian EV industry.

Connected vehicles

The global automotive industry has witnessed a lot of transformation in the last two decades with the digitisation of vehicles. It is moving towards the concept of 'connected vehicles', which focusses on connecting vehicles with the outside world and enhancing on-board experience. Automotive telematics combines telecommunication and informatics to provide various services such as live traffic updates, smart routing and tracking, roadside assistance in case of accidents, automatic toll

transactions, automatic parking / parking management, on-board entertainment, and much more. According to a study, the global connected car market will grow three-fold and is expected to reach INR2,757* billion in 2018¹⁹.

Global connected car market: 2012-18 (in INR billion)



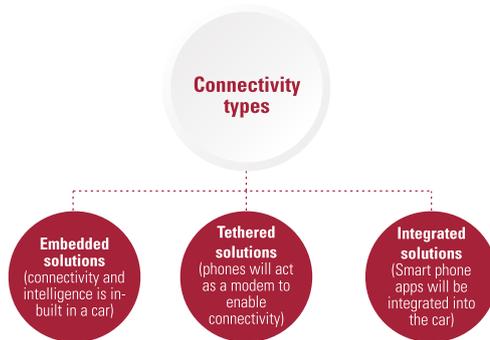
Source: Connected Car Forecast: Global Connected Car Market to Grow Threefold within Five Years, February 2013, GSMA



19. Connected Car Forecast: Global Connected Car Market to Grow Threefold Within Five Years, February 2013

Automotive telematics helps connects a car with the outer

world in three ways:



Source: 2025 Every Car Connected: Forecasting the Growth and Opportunity, February 2012, SBD and GSMA

According to a study, by 2025, 90 per cent of the new cars sold globally will come with embedded telematics, creating a value chain of INR1,343 billion*. Also an estimated 600 million cars, with fitted embedded telematics will be on the road, out of which India will have approximately 40 million cars²⁰.

However, the Indian telematics market has only been exposed to basic telematics services such as GPS-enabled navigation and vehicle tracking systems. In 2012, out of the 2.6 million new cars sold in India, only 7,000 came with an embedded navigation system²¹. Telematics adoption has been very less in the passenger cars and trucks (due to large number of single truck owners for whom installing high-cost telematics would affect margins as compared to fleet owners) as compared to commercial vehicles, taxi companies and fleet operators.

However, the usage of telematics in the Indian automotive industry has shown a positive trend in the recent years. In 2013, an EV with telematics was launched in India, where the owners of the car could access services such as knowing the battery's charging status and the distance the car can travel with the available charge, remotely control air conditioning, finding the nearest charging station, activating the reserve energy in the battery through a smart phone app, and a lot more. The government is pushing the use of telematics in vehicles by making it mandatory for taxi owners, including those who run on app-based services, to install GPS and panic buttons in their taxis²².

Telematics is quite popular in the organised sector in India. Some business models currently prevailing in the industry use it for car rental and self-driven cars.

In both the business models the user can book a car/taxi through smartphone applications and can pay online. The Indian taxi market was estimated at INR540 billion in 2013, with less than 10 per cent of the sector being organised²³. With increasing number of organised players in the market, the car rental market is expected to take a U-turn. The Indian car rental business is growing with a CAGR of 12 per cent and is expected to reach INR937 billion* in the next five years with 50 per cent share being occupied by the organised sector. Though these business models use basic level of telematics, with increasing users of smartphones and more investments coming in, the sector is expected to grow in the future.

20. 2025 Every Car Connected: Forecasting the Growth and Opportunity, February 2012, SBD and GSMA

* Currency converted, 1 EUR = INR70.6942, RBI reference rate as on 13 July 2015, NSE

** Currency converted, 1 EUR = 68.8934, Average rate from 1 January 2012 to 31 Dec 2012, OANDA

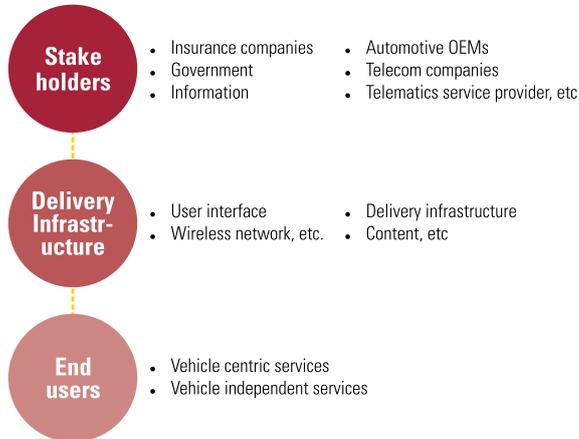
21. http://www.infosysblogs.com/engineering-services/2013/04/telematics_market_in_india_-_a.html

22. <http://timesofindia.indiatimes.com/india/GPS-panic-buttons-must-for-taxis-Government/articleshow/46363591.cms>

23. <http://www.ibef.org/blogs/indian-car-rental-industry-opportunity-to-build-and-indian-travel-brand>

However, the penetration of telematics and the effective delivery of connectivity-based services, largely depends on their integration

amongst the stakeholders operating in the ecosystem, which mainly consists of:



Source: Telematics: Force of change in automobiles, October 2014, Automotive Products Finder, as accessed on 11 June 2015

India has a huge potential in telematics, as it has the world's second and third largest users of mobile phone and internet, respectively, with the Indian telematics market expected to touch INR18.82 billion* by 2021²⁴. Through several government initiatives, a growth in the organised cab services, driving fuel efficiency amongst fleets and reducing vehicle thefts and accidents could drive the adoption of telematics in India.

Electronics

Developments in engine management and a rise in demand for connected, safer and greener vehicles are expected to be key growth drivers for the Indian automotive electronics industry, a market which has exhibited exceptional potential in the last few years and is expected to grow further. The Government of India has received investment proposals of INR180 billion during the period of July to December 2014 for its 'Make in India' initiative, which has mainly come from the automotive electronics sector²⁵. There is a

growing number of electronic embedded systems in two-wheelers as well as passenger and commercial vehicles such as ABS, Electronic Control Units (ECUs) for engine management, park assist, Electronic Stability Programme (ESP), glow plug timers, Capacitive Discharge Ignition (CDI), remote key, wipers, start/stop feature, power windows and steering. ABS and air bag control units are nowadays being installed not only in luxury cars, but also in mid-segment cars by manufacturers.

Electronics has been one of the largest drivers for change in the automotive sector. Developing a less expensive electronics architecture is expected to expedite the demand for electronics and enable sophisticated functionalities as standard features. Globally, electronic components are expected to be 50 per cent of the value of a car by 2030, from the current 30 per cent²⁶. Presently, in India automotive electronics contribute to around 10 to 15 per cent of the total cost of a car²⁷.

24. <http://www.mynewsdesk.com/in/pressreleases/india-telematics-market-estimated-to-reach-301-23-million-by-2021-1115656>

* Currency converted, 1 USD = INR63.4655, RBI reference rate as on 13 July 2015, NSE

25. <http://www.teleanalysis.com/analysis/why-automotive-electronics-contribute-majority-of-rs-18000-cr-investment-11786.html>

26. <http://www.statista.com/statistics/277931/automotive-electronics-cost-as-a-share-of-total-car-cost-worldwide/>

27. Why automotive electronics contribute majority of Make in India investment?, TeleAnalysis, 22 December 2014

For several global suppliers, the development takes place in their home market without much of activity in India. The captive centres of foreign automakers are mainly working for their parent companies located in the U.S. or Europe. If these centres start working on products specifically for India, then the automotive electronics industry and its R&D in India may face a bigger opportunity.

Current platforms of Indian OEMs and Tier 1 cities are still quite basic and are based on old technologies, where electronics does not play a big role. However, the trend has caught up in recent years, with product roll-outs consisting of technologies like CAN (Car Area Network).

Many captive R&Ds have partnered with electronics manufacturers and are working with them either on project basis or resource basis, including innovations. The electronics manufacturers are targeting Tier 1 cities for India specific components for customised design solutions (e.g. integration of Low-dropout regulator (LDO), Microcontroller (uC), High-Side/Low-Side driver (HS/LS drivers), Controller Area Network Physical Layer (CAN Phy)), Application-Specific Integrated Circuit (ASIC) / System-on-Chip (SoC solutions), scalability of two and four-wheeler segments, design and validation. Growing automotive electronics market, increasing re-engineering activities that are taking place in India are creating opportunities for the Indian market.

Indian IT and software companies are playing a crucial role in the development of global automotive electronics industry, considering the country is one of the largest exporters of IT and software services to the industry. Software companies partner with global automotive OEMs and provide broad project implementation services for electronic modules such as body controls (electronic mirrors, chassis like electronic steering), infotainment, safety and security (airbags), etc. The services provided by IT companies are software design and development, system integration and testing, HIL, SIL, MIL testing, etc. The increase in embedded systems and electronics in the next generation vehicles is expected to further boost the demand for software services.

Despite the fact that the average electronic content per vehicle in India is still less compared to European and other markets, the demand for advanced engine control and management systems and superior safety systems is increasing gradually in India, as car manufacturers demand components at competitive prices.

Due to the emergence of Internet of Things (IoT), digital electronics is acting as an important driving force behind many innovations in the industry. Provision of in-vehicle communication and entertainment systems, known as connected infotainment, is a new opportunity in the Indian market and is anticipated to drive the electronic component sector.

7 Supply chain capacity

With the advent of new technologies and trends in the automotive industry, transformation of the value chain is inevitable, as capability building of capacities may require close collaboration and cooperation of almost all players in the supply chain. Participants who are best equipped to seize upcoming opportunities and counter the associated challenges would emerge as a successful supply chain.

Safety

With rising safety concerns due to a high number of road fatalities in India every year, the government is taking adequate steps towards mandating advanced safety features in automobiles such as making ABS compulsory in all commercial vehicles at the start of this fiscal year²⁸. Similar policies are expected in the future for all classes of vehicles, impacting the entire auto value chain. While global automakers are not new to basic safety features such as airbags, seatbelts, ABS, Autonomous Emergency Braking (AEB), safety assist, child occupant protection, adult occupant protection, etc. a major challenge in India has been to develop the same low-cost safety features for the price-sensitive market. Large global auto component players have begun working on designing affordable safety features for India, with one

such low-cost solution for airbag control already being developed by a leading supplier. Clearly, once new safety norms are mandated, suppliers that can provide more economical solutions are likely to have a competitive edge.

Emission norms

Currently, BS-IV emission norms are in place in 33 cities all over India, while BS- III is the norm in the rest of the country. The new government has been keen on advancing the timelines to roll out BS-VI norms and skip the BS-V stage altogether²⁹. However, this has serious implications for the auto value chain, specifically for engine component suppliers. A large global auto component manufacturer in India has already expressed its inability to the government to roll-out a BS-VI compliant engine within the stipulated timelines and has stated that even a BS-V compliant engine would need a lead time of more than four years. The supplier has also warned of serious safety and quality implications if appropriate time and effort is not spent on the development of the new engines³⁰, which would not just require advanced features such as Diesel Particulate Filter (DPF) and Selective Catalytic Reduction (SCR), but may also require well developed infrastructure for driving. According to estimates, the changeover from BS-IV to BS-V may also need an industry-wide investment of INR500 billion³¹, which may require collaboration of OEMs as well as lower tier suppliers to effect the change.

28. <http://auto.ndtv.com/news/abs-now-compulsory-for-trucks-and-buses-751343>

29. [http://indianexpress.com/article/india/india-others/government-in-a-rush-to-upgrade-](http://indianexpress.com/article/india/india-others/government-in-a-rush-to-upgrade-emission-norms-but-wheres-the-engine-wheres-the-fuel/)

[emission-norms-but-wheres-the-engine-wheres-the-fuel/](http://indianexpress.com/article/india/india-others/government-in-a-rush-to-upgrade-emission-norms-but-wheres-the-engine-wheres-the-fuel/)

30. <http://www.livemint.com/Industry/xnliqOgR3SzznHXpkX6xjO/SkippingBSVmay-put-cars-at-risk-Bosch.html>

31. <http://indianexpress.com/article/india/india-others/government-in-a-rush-to-upgrade-emission-norms-but-wheres-the-engine-wheres-the-fuel/>

Lightweighting

Though the role of large OEMs cannot be understated in the development of cost-effective and strong, lightweight materials, a KPMG International survey suggests that Tier 1 suppliers are equally expected to control the R&D and production of such materials³². While lightweighting provides new opportunities for suppliers, it could be a threat to Tier 2 suppliers if they are unable to adapt, paving the way for new players to enter the value chain.

In order to sustain, component suppliers may need to invest in R&D and shorten their development cycle to meet the demands of faster response time of the OEMs³³. However, in India, as witnessed during the post-liberalisation period, OEMs themselves have to participate actively in building and preparing local suppliers for the new trends, if they intend to continue sourcing components locally at low costs. Lightweighting could also mean new manufacturing processes, investment in new machines, etc. and OEMs may not just have to handhold their suppliers to develop and implement new technology, but may also need to provide financial resources in the form of debt or equity to build capacity. OEMs may also need to form agreements to share costs with their suppliers during a recall, so as to overcome the inertia in the supply chain for the new developments.

Electrification of power trains

Lithium ion battery in EVs have replaced the traditional lead-acid battery used in automobiles due to its lighter weight, quicker charging times, higher efficiency and longer range. In India, though OEMs can procure these batteries from global manufacturers for their electric vehicles, it may be in their best interest to develop capabilities of local lead-acid battery suppliers to keep costs low in the long-term. The capabilities of existing players can be built quickly through strategic acquisitions and OEMs may need to play a role in financing such acquisitions.

To establish a viable e-mobility market OEMs must also collaborate with other players of the value chain that include utilities, charging infrastructure, application developers, owners of charging location, leasing companies, etc. They must also come up with innovative business models so that they can improve the attractiveness of EVs to end customers by providing services like lease, rent or share EVs; service for batteries, mobile services, etc.

Connected vehicles and electronics

Connected vehicles technology is transforming the automotive supply chain beyond the realm of traditional players to newer players from non-automotive industries. The value chain may comprise providers of components, on-board software, wireless connectivity, delivery infrastructure, telematics service, infotainment content, the OEMs and the end-users³⁴. Thus, it provides opportunities for companies in sectors such as

technology, semi-conductor, and telecommunication to be a part of the burgeoning automotive industry and extract benefits.

To emulate the success of digitisation and the advent of electronics in other industries, automotive OEMs may have to transform the conventional operating model of their organisation as well as drive changes in the supply chain. They may need to invest in dedicated R&D setups for on-board electronics and connectivity. Some large global OEMs are pioneering work on connectivity solutions through their spin-offs, dedicated R&D units and through strategic investments in adjacent sectors. OEMs also need to partner closely with Tier 1 suppliers to build their capability. Some large global Tier 1 suppliers have already established their own R&D units to take pre-emptive action and to stay ahead of the competition. However, in India, OEMs may have to play a larger role in handholding and financing their suppliers who can, in turn, play an important role in connectivity. This may be in the best interest of the Indian and global OEMs who are keen to leverage the localised low-cost solutions in India.

Though non-automotive players may look to partner with the OEMs, the extent to which the latter and their traditional suppliers can defend their ground, depends on how well they build their competence to meet the new challenges. On the other hand, the success of new players in capturing an uncharted territory could depend on their ability to adapt to the changing requirements of the new automotive ecosystem.

32. KPMG Global Automotive Executive Survey, KPMG International, 2012

33. "Step on the Gas", Wipro, June 2014

34. <http://www.infosys.com/industries/aerospace-defense/industry-offerings/Documents/connected-vehicles-technology.pdf>

Government support and policies

The Indian government has always played a key role in formulating policies and creating an enabling environment so that OEMs and suppliers can bring appropriate and relevant technologies to the market. The government is working on initiatives such as the implementation of Intelligent Transportation Systems (ITS)³⁵ which augurs well for the automotive industry, as it could give a boost to the connected vehicles technology segment.

However, there are certain other areas that require urgent government intervention to help develop new technologies. Due to restrictions on use of certain required frequency bands, Indian automakers are not able to test or make components for vehicles with Advanced Driver Assist Systems (ADAS). This has also restricted global OEMs to introduce their cars with ADAS in the Indian market³⁶.

Summary

In the coming decade, automotive players may have to embrace new technologies and trends, driven by changing customer demands as well as government regulations regarding safety and environmental concerns. In the Indian market, the price-sensitivity of the consumer could drive critical changes in the industry and may require innovations in both products and processes. This transformation may not just need an active collaboration between all the existing players of the value chain, but may also require leveraging synergies of non-automotive industries. The government too would have to be in sync with the needs of the industry and play an active role in the transformation.

35. <http://deity.gov.in/content/intelligent-transportation-system-its>

36. <http://www.dot.gov.in/sites/default/files/u8/Tata%20Automotive%20Industry.pdf>



About KPMG

KPMG in India

KPMG in India, a professional services firm, is the Indian member firm of KPMG International and was established in September 1993. Our professionals leverage the global network of firms, providing detailed knowledge of local laws, regulations, markets and competition. KPMG has offices across India in Delhi, Chandigarh, Ahmedabad, Mumbai, Pune, Chennai, Bangalore, Kochi, Hyderabad and Kolkata. We strive to provide rapid, performance-based, industry-focussed and technology-enabled services, which reflect a shared knowledge of global and local industries and our experience of the Indian business environment.

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About ACMA

The Automotive Component Manufacturers Association of India (ACMA) is the apex body representing the interest of the Indian Auto Component Industry. Its active involvement in trade promotion, technology up-gradation, quality enhancement and collection & dissemination of information has made it a vital catalyst for this industry's development.

ACMA's charter is to develop a globally competitive Indian auto component Industry and strengthen its role in national economic development as also promote business through international alliances. ACMA is an ISO 9001:2008 certified Association.



Glossary

Acronyms

ABS	Anti-Lock Braking System
ADAS	Advanced Driver Assist Systems
AEB	Autonomous Emergency Braking
ASIC	Application-Specific Integrated Circuit
BMS	Battery Management System
BNVSAP	Bharat New Vehicle Safety Assessment Programme
BS	Bharat Stage
CAFC	Corporate Average Fuel Consumption
CAGR	Compound Annual Growth Rate
CAN	Car Area Network
CAN Phy	Controller Area Network Physical Layer
CDI	Capacitive Discharge Ignition
CNG	Compressed Natural Gas
DPF	Diesel Particulate Filter
ECU	Electronic Control Unit
ESP	Electronic Stability Programme
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GPS	Global Positioning System
HIL	Hardware-in-Loop
HS/LS Drivers	High-Side/Low-Side driver
ICE	Internal Combustion Engine
INR	Indian Rupee
IoT	Internet of Things
IT	Information Technology
ITS	Intelligent Transportation Systems
LDO	Low-dropout regulator
LPG	Liquefied Petroleum Gas
MIL	Model-in-Loop
MPV	Multi-purpose Vehicle
NCAP	New Car Assessment Programme
NEMMP	National Electric Mobility Mission Plan
NEV	New Energy Vehicles
OEM	Original Equipment Manufacturer
R&D	Research & Development
SCR	Selective Catalytic Reduction
SIAM	Society of Indian Automobile Manufacturers
SIL	Software-in-Loop
SoC	System-on-Chip
SUV	Sports Utility Vehicle
µC	Microcontroller
UN	United Nations
WHO	World Health Organisation



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