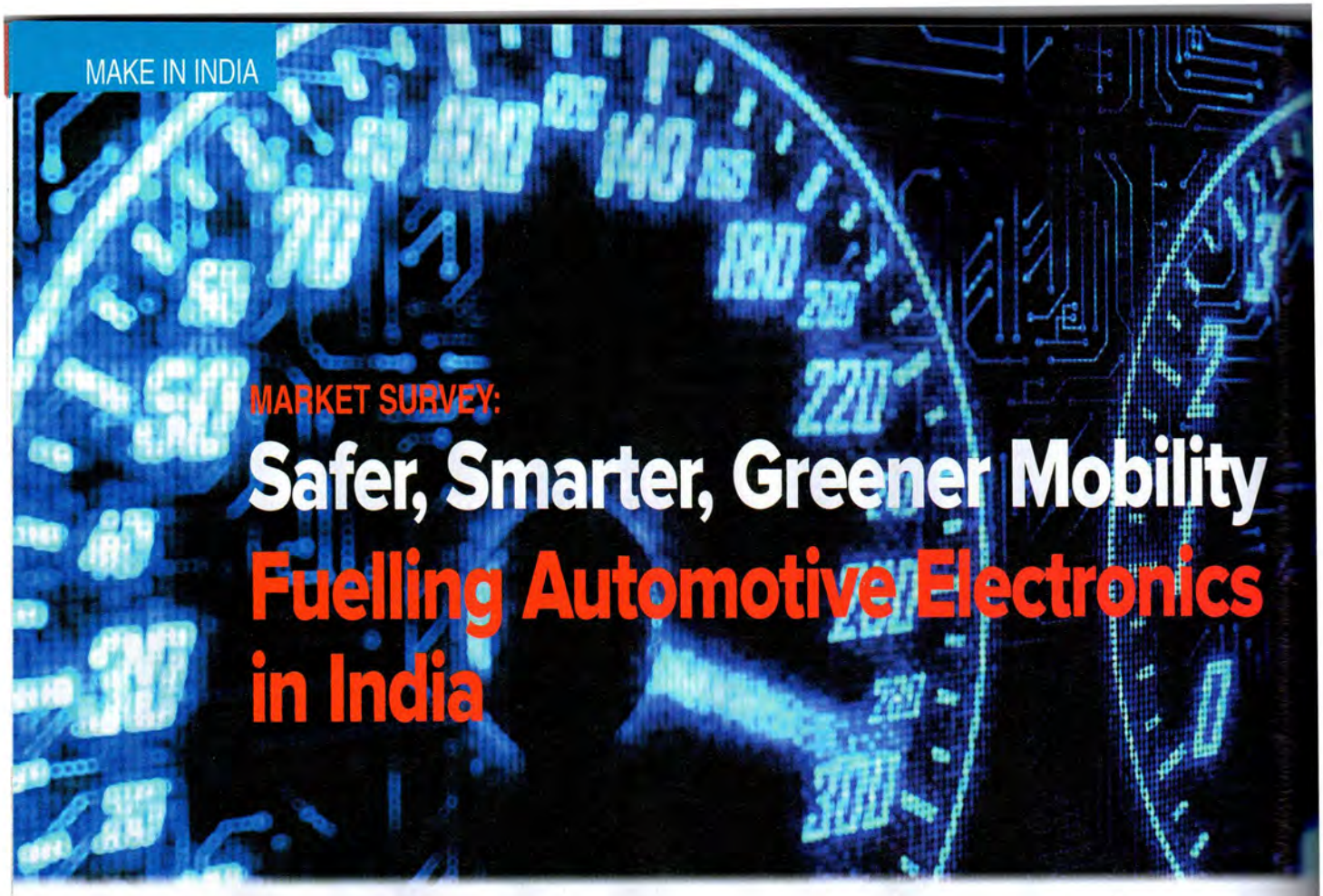

MARKET SURVEY:

Safer, Smarter, Greener Mobility

Fuelling Automotive Electronics in India

Sudeshna Das is senior executive editor at EFY

Automotive electronics plays an important role in sensing, computing and actuating the different features and functionalities of a car. "In the 1980s, total electronics content of a car accounted for around three per cent of the total vehicle value; today, it is more than 20 per cent and by 2020, it is likely to further increase to 35 per cent," says Edoardo Merli, director, marketing and application automotive product group, Greater China and South Asia Region, STMicroelectronics, while discussing the growth potential of the Indian automotive electronics market.

Automotive electronics has gained importance on account of the growing consumer demand for performance, safety, comfort, convenience and entertainment from their vehicles. The car of the future is expected to be equipped with even more advanced features that would help prevent accidents, entertain occupants and at the same time, be gentler on the environment. In fact, in the not-so-distant future, cars may not require drivers at all.

"With growing demand around safety, comfort and entertainment, electronification of the automobile will be key. In addition, stricter emission norms make it necessary to have more electronics in the vehicle," says Prabhu Panduranga, managing director, Bosch Automotive India Ltd.

Given that, one of the ways automotive companies look to expand their market share is by introducing novel features and most of these features are driven by electronic components, the auto-electronics segment can continue on a positive run even if the auto sector as a whole underperforms.

In this report, we will take a peek into the significance of electronics in the evolution of automotive technology, followed by a discussion on the capability and growth potential of the Indian automotive electronics sector.

From mechanical to electronic

Innovation in automotive electronics has grown in leaps and bounds in the last four decades, driven primarily by advancement in microcontroller (MCU) technology and software systems that control vehicle systems.

"Adoption of electronics in the automotive sector began in the 1970s, with the use

of radios, alternators and voltage regulators that controlled the alternators. Engine management was the next big thing with the introduction of electronic fuel injection technology. Majority of the innovations in sophisticated engine management and transmission control have been driven by electronics through the use of MCUs, semiconductor switches and sensors. Moreover, low-cost and reliable electronics have also made body and convenience applications more efficient and standardised in modern vehicles," explains Rajeev Ramachandra, chief technology officer and co-founder, Mistral Solutions.

Application of electronics has since expanded to other vehicle systems from the days of the radio and alternator. Many sophisticated safety systems in modern cars would not have been possible without the use of electronics. In addition, the recent convergence of communication and entertainment needs have also driven rapid development of the infotainment segment in vehicles.

These developments have been made possible through the substitution of mechanical parts by electronics, more precisely, the marriage of mechanical actuator parts with electronics to develop a new area known as mechatronics, which facilitated further growth of the automotive electronics industry.

Fig. 1: Significant automotive manufacturing base of OEMs: Indian and global (Source: ACMA)

Tracing automotive electronics innovations

1970s: Introduction of electronics for engine controls
1980s: Introduction of anti-lock braking
Early 1990s: Standardisation of airbags
Late 1990s: Rapid expansion of body electronics, such as seat motors (body computers), instrument panel lighting, auto-locking systems and keyless entry
Early 2000s to date: Infotainment including sophisticated audio and video, signals sent via satellite (such as OnStar System), GPS and mapping capabilities, and satellite radio
Late 2000s: Steer-by-wire, wireless connectivity

Source: Infineon

India riding the growth wave

The automotive electronics industry, a sub-set of the auto components industry in India, grew out of the offshore transfer of automotive design centres by multinational semiconductor manufacturers to leverage the country's IT expertise in design, development and simulation.

India has been seen as a base for prototyping, testing, validation and production. Global automotive original equipment manufacturers (OEMs) are also shifting automotive research and development (R&D) centres to India not only to take advantage of cost arbitrage but to also incorporate relevant design customisations to suit the local market. Moreover, automotive electronics manufacturing is also gaining importance in the country.

Where does India stand in automotives

- Largest tractor manufacturer
- Second-largest two-wheeler manufacturer
- Second-largest bus manufacturer
- Fifth-largest heavy truck manufacturer
- Sixth-largest car manufacturer
- Eighth-largest commercial vehicle manufacturer

Source: ACMA

The Indian auto components industry is expected to register a turnover of US$ 66 billion by 2015-16 with the likelihood of touching US$ 115 billion by 2020-21, depending on favourable conditions, as per the estimates of Automotive Component Manufacturers Association of India (ACMA). In addition, industry exports are projected to reach US$ 12 billion by 2015-16 and add up to US$ 30 billion by 2020-21.

Future growth of automotive electronics industry in India will be driven primarily by the rapidly growing passenger car market, adoption of automotive electronics, and consumer behaviour and demand.

Rapidly growing car market. The Indian automotive industry is witnessing a phase of rapid transformation and growth, driven primarily by stable economic growth and a focus on infrastructure development. In the past two decades, the country has become a favourite destination of global OEMs for offshore transfer of production due to low production cost and increasing local demand. This, in turn, has contributed to the development of some major automo-

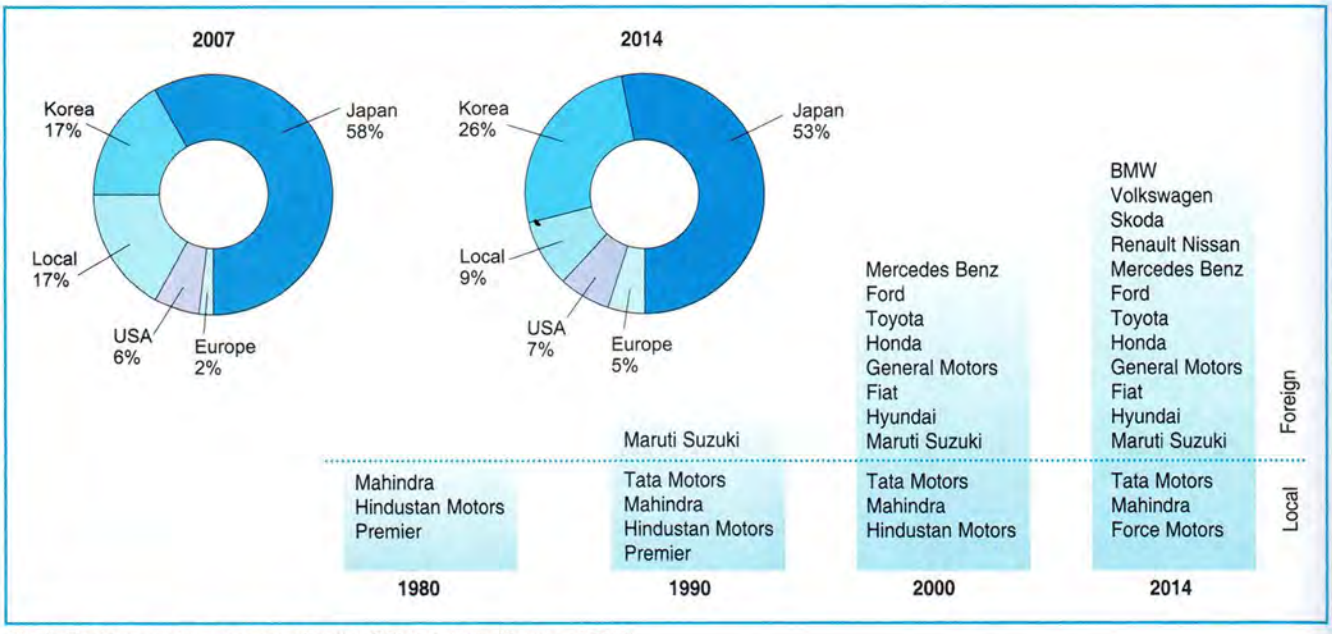

Fig. 2: Rapidly growing presence of global OEMs in India (Source: ACMA)

tive clusters across the country (Fig. 1). In comparison with the 1980s, when only a few local OEMs were present, India is now a manufacturing hub with significant presence of global and local OEMs (Fig. 2).

"From being a low-key supplier providing components exclusively to the domestic market, the industry has emerged as one of the key auto centres in Asia and is today seen as a significant player in the global automotive supply chain," says Nitin Pai, senior vice president, TATA Elxsi.

While specifying the opportunities that exist for automotive electronics, S. Ganesh Kumar, country sales manager, Atmel R&D India Pvt Ltd, opines, "Indian automotive product range varies from ultra-low-cost as the majority share up to mid-level cars. Each of these specific target products definitely requires some sort of electrification and electronic controls to enable highest efficiency and achieve some sort of comfort level. All these requirements create the potential for automotive electronics."

In addition, the two-wheeler segment, which dominates the automotive market in India, and commercial vehicle segment also show demand for electronics.

Adoption of automotive electronics. In the early years of the automotive industry in India, manufacturers would use streamlined manufacturing processes as their competitive advantage as opposed to innovation. Electronics features, adopted by global car makers, would typically be given a miss by their Indian counterparts.

Process efficiency having reached its peak, the focus is now on innovation or additional novel features that are based primarily on electronic components. In fact, regional automotive manufacturers and design teams of global manufacturers present in India are increasing their focus on utilising technology to differentiate themselves from their peers.

The need for reduced production cost, coupled with increased quality along with customisable novel features, all within shorter business cycles, is driving an increased focus on the role of electronics within the region's automotive manufacturers.

Electronics content will become more advanced with each new generation of vehicles produced in India. "Implementation of properly-designed electronic systems can even reduce cost, while increasing flexibility and reliability of a vehicle," says Ramachandra. This suggests great potential for the automotive electronics market.

Consumer behaviour and demand. Demand patterns of automotive electronics in the country are driven by local consumers and export requirements. Consumer needs typically focus around affordability, prestige, mobility, environmental conscience, safety, comfort and a host of other factors.

Affordability, for example, plays a huge role behind the miniscule share of the premium car segment in India. The ultra-low-cost (ULC) segment targeted by Tata Nano addresses the consumer's need for affordability, which is in head-on competition with the motorcycle—the current dominant form of private transportation in India. The major challenge for suppliers in this segment is to innovate technologically and business-wise in order to create a profitable and sustainable business model, keeping in mind price sensitivity.

A recent study, conducted by a team from *Electronics Bazaar*, among a select group of millennial or gen Y folks in the metro cities of India found that in-car electronics such anti-lock braking system (ABS), smart air-conditioning, power windows, and head and side airbags are

the features most wanted by prospective car buyers. The study also suggested that fuel consumption, cost-performance ratio, safety, price, design and comfort are considered to be the major selling points.

This is good news for the automotive electronics sector, which has been hard at work developing power train and chassis improvements designed to reduce fuel consumption and improve long-term cost-performance ratio levels. Factors like safety, comfort, telematics and in-car infotainment are also some of the current major industry themes. However, at the same time, it is important to note that Indian consumers who drive medium- or low-cost vehicles are interested in having the latest features in their vehicles that are also price sensitive in nature.

According to Pai, "Today, car makers are competing to bring in advanced features, connectivity, entertainment, advanced safety and improved fuel efficiency to their products to attract potential buyers. To address this ever-increasing list of consumer needs, more and more technological advancements are, and will keep, happening, and automotive electronics will play a pivotal role in satisfying all user requirements. This paves the way for complex electronic systems. Therefore providing cost-competitive electronic solutions is a challenge and an opportunity for Indian automotive companies."

Electronic consumption by the automotive segment

Power train and chassis
- Diverse electric motors
- Electrical (turbo) charging
- New igniters and advanced sensors
- Automated manual transmission
- e-braking, e-steering, e-suspension
- Electronic stability control
- Start-stop system

Safety
- Rear cameras
- Lane departure warning
- Adaptive cruise control
- Blind-spot detection
- Map-supported adaptive front lighting
- Tire-pressure monitoring system
- Curve warning
- Speed alert
- Collision warning/avoidance
- Usage data transmission

Telematics and infotainment
- Fixed and portable navigation devices
- Multimedia features
- Bluetooth
- eCall
- Voice based, haptic and human-machine interface (HMI) systems and touch
- Real-time traffic information
- Parking assistants
- Social media
- Wi-Fi hotspot, smartphone interface

Comfort and convenience
- Adaptive front lighting
- Steering wheel buttons
- Central/heads-up displays
- Voice-control systems
- Xenon headlights
- LED/ambient lighting
- Touchscreens
- Remote control
- Well-being assistants

Source: Frost & Sullivan Report, 2014

Safer, smarter, greener options

According to an iSuppli Corp. report, technological development in engine management and incorporation of safety systems in cars are expected to be the key growth drivers for the Indian automotive electronics market in the next five years as it attains a compound annual growth rate (CAGR) of 21.8 per cent.

Electronics plays a key role in improving road safety. Safety applications in India are currently policy-driven, possibly due to the cost sensitivity of the Indian market. Car safety is set to receive a serious boost in the country with the government planning to make ABS, airbags and other safety equipment compulsory on all passenger cars sold in India. As per the proposal, India will have its own vehicle safety standard called India New Car Assessment Programme (NCAP), which is similar to United Nations' NCAP.

This would present a serious challenge for ultra-low-cost and two-wheeler segments as safety features found typically in higher-segment cars are expensive. This will also, no doubt, force automotive innovation in yet another direction, as car makers and suppliers attempt to meet emission and safety standards at a low cost.

According to Merli, increasing electronics content in the two-wheeler segment is likely to fuel the demand for optimised semiconductor solutions suitable for cost-sensitive markets.

Merli also pointed towards the huge scope that exists in the commercial vehicles space. In India, safety and emissions in commercial vehicles are a huge concern for regulatory authorities. This might result in setting new mandates in this segment. For example, ABS is now mandatory for commercial vehicles, which may be followed by regulations in tire pressure-monitoring systems (TPMSes). And eventually, all these will result in increasing the electronics content in commercial vehicles, too.

Emission reduction also poses a major challenge for the Indian commercial vehicle manufacturers, and regulations with respect to emission would be made mandatory in India soon, which would provide an impetus for growth in the Indian automotive segment, especially in power train and transmission.

In addition to ABS, incorporation of some advanced driver assistance systems (ADASes) will also help to make Indian cars safer and will definitely increase the electronics content of the cars. In this regard, Pai referred

MAJOR CONTRIBUTORS TO THIS REPORT

Edoardo Merli, director, marketing and application automotive product group, Greater China and South Asia Region, STMicroelectronics

Nitin Pai, senior vice president, TATA Elxsi

Prabhu Panduranga, managing director, Bosch Automotive India Ltd

Rajeev Ramachandra, co-founder and vice chairman, Mistral Solutions

S. Ganesh Kumar, country sales manager, Atmel R&D India Pvt Ltd

Facts and figures: Indian automotive electronics market

- Automotive electronics account for around five per cent of the total semiconductor market size of US$ 7 billion
- On average, total electronics content of an Indian vehicle is around ten per cent, with an average value of US$ 50 per car and US$ 5 per two-wheeler

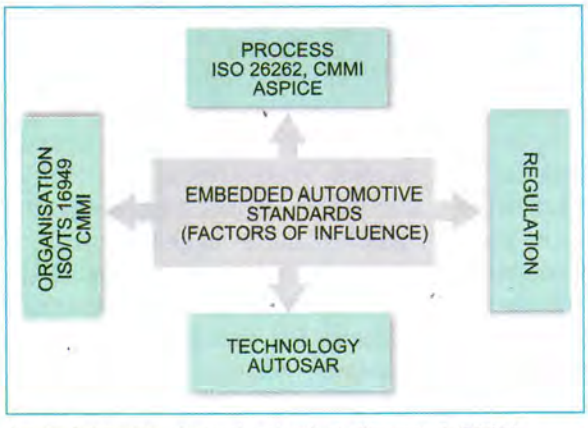

Fig. 3: Automotive electronics standards (Source: NASCOM)

to systems like lane-departure warning system that alerts the driver if he/she veers away from lanes, drowsiness detection system, blind-spot monitoring system that enables the driver to view areas around the car that are not viewable with standard mirrors and so on. Another area that might see additional inclusion of semiconductors will be in body control modules (BCMs), integrated systems for controlling various body peripherals like lighting, wipers and HVACs.

Harmonised development through standards

The growing amount of electronics in power train, chassis, body control and infotainment applications in passenger cars and vehicles in India make it increasingly challenging to manage development of complex embedded systems that integrate software and hardware from a large set of suppliers. Therefore adoption of globally-established standards will enable the industry to harmonise their development activities to compete effectively.

Standards governing the automotive electronics landscape can be presented as a triad of technology, process and organisation (Fig. 3). It is acknowledged that, standards are also driven by government policy and regulations (for example, legislative and emission), keeping in mind future demands.

Both Merli and Ramachandra point out that the significance of standards must be taken into consideration if the Indian automotive industry has to cope with the increasing vehicle system complexity and an increase in safety-relevant functions in embedded systems.

"From our perspective, quality standards within the India automotive industries are at par with any emerging developing country standards such as BRIC countries," opines Kumar.

Sustainable mobility

India is now paving the way forward in future mobility. Technological advancements are changing the way we think about cars in terms of energy efficiency, safety, comfort, car-to-x communication and even infotainment solutions, explains Ramachandra.

In future, security and connectivity would need to run hand in hand. For example, a user entering the car and connecting his personal device to the head unit would compromise vehicle security. While improved connectivity enables the car to access information continuously from the cloud and provide enhanced services to the driver and passengers, it also becomes vulnerable to potential hacking and even tampering of the controls of the vehicle, endangering its occupants. Pai suggests, enhanced security platforms such as secured gateway modules could act as a central hub and a gatekeeper between the vehicle and the outside world to prevent unauthorised access.

The ever-increasing functionality, applications, convenience and user-friendliness of smartphones and tablets have influenced the automotive industry to work on integrating these devices or similar functionality into the vehicle.

Presently, these devices can be paired to the head unit of the car and engage in a whole set of functions like voice calls, navigation and audio/video content. "Connected cars of the future will seamlessly integrate smartphones, wearables and sensors into the car, and provide users not only with applications such as cloud based navigation, real-time traffic updates, fuel reminders, location of parked vehicles and emergency/service assist, but also provide features such as active health monitoring

and personalising the driving experience of the driver," predicts Pai.

Further integration of connectivity features like Wi-Fi, DLNA and MirrorLink will enable users to have access to content on the move. According to Panduranga, however, connected car is the new trend with a lot of possibilities, but the industry needs some more time to evaluate its true benefits.

With increasing fuel costs and pollution levels, sustainable growth of the automotive industry depends on the use of alternative fuels and energy sources like fuel cells, solar power and electric power. Introduction of green technologies in the form of hybrid and electric vehicles would strongly increase the use of sophisticated electronic controls to achieve maximum efficiency and reliability.

"Electrification of cars using hybrid engines is one potential for exploration in India. For the short-term, full electric cars might not be suitable considering the electrical grid infrastructure and charging facilities required. However, hybrid engines enable the highest efficiency possible in specific usage environment, in addition to cutting back the pollution in cities," says Kumar.

While commenting on futuristic technologies, Ramachandra mentioned the need for complete control of the infotainment system as well as importance of collision-detection systems through car-to-car information exchange without any human intervention.

Make in India, on the way

According to Department of Electronics and Information Technology (DeitY), majority of investment proposals received by the department in the last one year for Make in India campaign are from the automotive electronics sector.

"As the industry requires coordination of logistics, basic infrastructure such as roads, networks, electric grid supply and support of all essential suppliers, these require effective government policies to support such growth," says Kumar.

While commenting on the possibility of increasing automotive electronics manufacturing in India, Panduranga opines, "With favourable investment policies and a large pool of talent, India does have a good chance of becoming a manufacturing hub."

He adds, "There are many schemes announced for the electronics manufacturing sector, which should encourage more investors to make in India. Both central and state governments encourage investments in the electronic system design and manufacturing (ESDM) sector. We are also one of the beneficiaries of modified special incentive package scheme (M-SIPS) scheme. It is moving in the right direction and I am sure more investments will happen in India. Special mention should be made about M-SIPS, where the entire process is handled in a transparent and professional way."