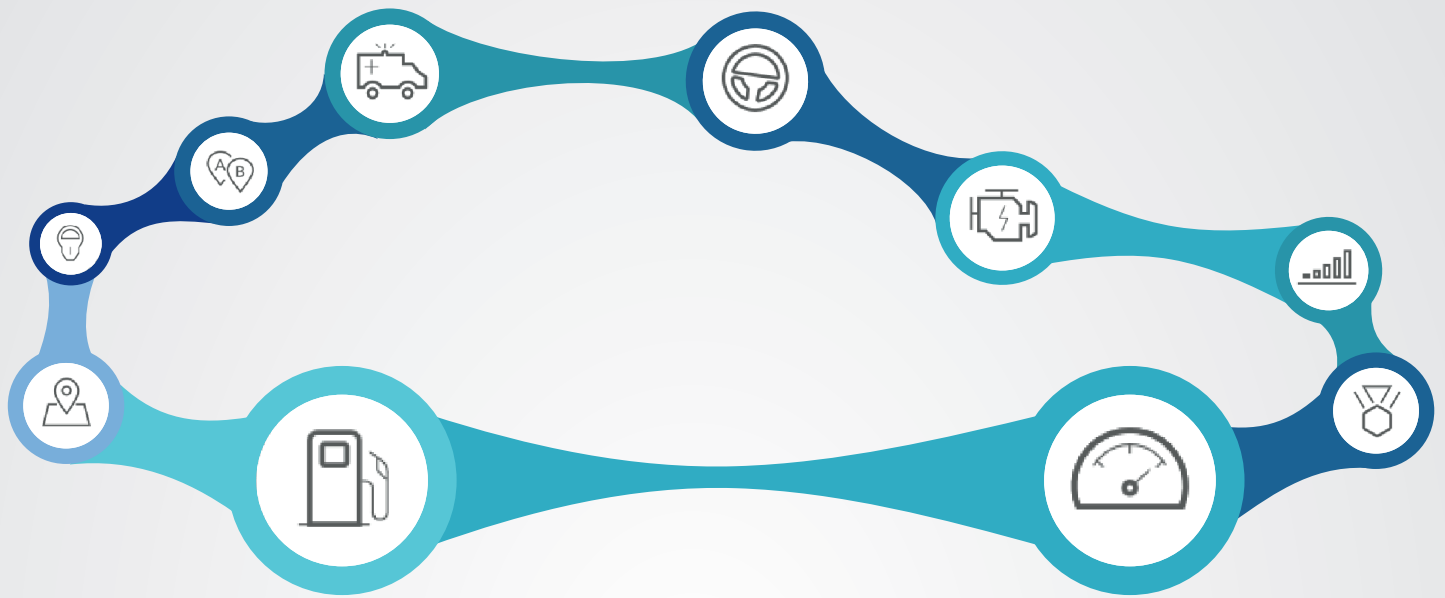# CONNECTED CARS
A RISING TREND IN THE GLOBAL AUTOMOBILE SECTOR

Thematic Report by
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TECHNOLOGICAL ADVANCEMENTS TO SET NEW TRENDS IN THE AUTOMOBILE INDUSTRY

Cars with access to the Internet, also known as connected cars, are gaining popularity in the automobile industry.

Its sales are expected to increase at a CAGR of 46% over 2015 – 20 and account for 75% of global car shipments by 2020, driven by increased demand from the young population (aged between 25 and 34 years) as well as higher demand from the North American and Asian regions.

Connected cars provide consumers with several technological advantages such as mobility management, vehicle management, entertainment, driving assistance, and safety features.

To offer these features in cars, automobile manufacturers would need to substantially upgrade their existing technologies and collaborate with mobile network operators.

However, the implementation of these features involves various challenges, particularly cyber security, including unauthorized access and hijacking.

Rise in Popularity of Connected Cars Offering Innovative Features

There are numerous benefits of being connected to the Internet through smartphones, tablets, and other devices. With the growing need for continuous access to the Internet, cars are being designed with Internet connectivity; this new trend is expected to gather pace in the automobile industry as car owners across the globe start to demand such features. Connected cars with embedded mobile technologies are expected to offer a range of new services such as safety via danger-warning applications, traffic information services, and other infotainment features. Furthermore, these features would improve vehicle maintenance by providing information regarding damage or repair to carmakers and owners.

Advanced Technological Features to Boost Demand for Connected Cars

Connected Car Segments Based on Features

Safety

Well-Being

Entertainment

Driver Assistance

Vehicle Management

Time & Cost Management

Mobility (Time & Cost) Management

This feature enables drivers to access real-time traffic information via navigation systems installed in the car, helping them to avoid traffic. Furthermore, these features enable drivers to access highway warnings and messages, allowing them to choose fuel-efficient routes based on current traffic.

Vehicle Management

This feature helps owners reduce maintenance costs. It includes remote-control unlocking, dynamic fault monitoring, service scheduling, and data transfer to fleet owners and insurance companies regarding car usage. Through these features, drivers can receive maintenance warnings, wherein anticipated problems can be solved in advance to avoid more serious problems. Furthermore, the compilation of such data from several cars can help carmakers determine areas of improvement, helping enhance the quality of their products.
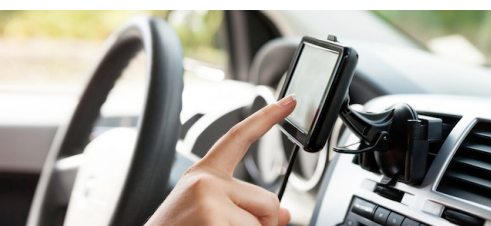
Entertainment

Connected cars with entertainment features, such as smartphone interfaces, access to social networks, Internet music and video, and other advanced mobile office functions are already immensely popular.

Driver Assistance

This is expected to become a key segment in connected cars. The category currently includes cars with features such as automatic self-parking and automatic braking for obstructions. However, advancements in technology are expected to spur driverless cars that may involve some monitoring or no intervention at all.

Safety

Connected cars with safety features provide warning and protection against vehicle damage as well as indications about external conditions such as road and weather conditions. The facilities to protect vehicles could include danger warnings, collision protection, and emergency functions. According to a news article in CBS News, the US Department of Transportation indicated the use of connected vehicle technologies could reduce the number of accidents by 83%.
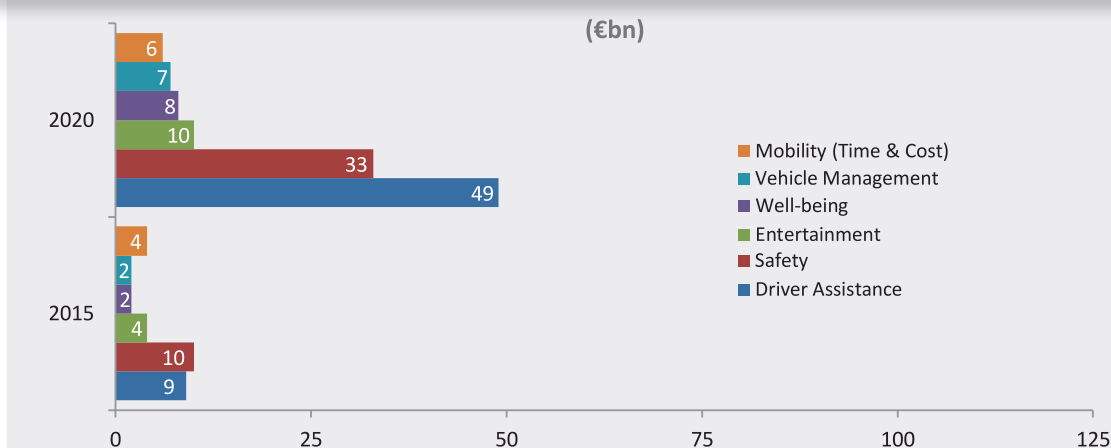
Well-being

Connected cars with well-being features include technological equipment that monitors drivers' health, comfort, ability, and fitness to drive the car.

By 2020, nearly 75% of new car shipments would have connectivity features. According to Statista, the overall market size of the segments among connected cars is expected to increase at a CAGR of 29.5%. It'll be worth about €115bn over 2015 – 20, with Driver Assistance, Well-being, Vehicle Management, and Entertainment being key growth segments.

Connected Car's Segmental Market Value Over 2015 – 20

(€bn)

Legend:
- Mobility (Time & Cost)
- Vehicle Management
- Well-being
- Entertainment
- Safety
- Driver Assistance

2020:
- Mobility (Time & Cost): 6
- Vehicle Management: 7
- Well-being: 8
- Entertainment: 10
- Safety: 33
- Driver Assistance: 49

2015:
- Mobility (Time & Cost): 4
- Vehicle Management: 2
- Well-being: 2
- Entertainment: 4
- Safety: 10
- Driver Assistance: 9

Source: Statista

Carmakers Collaborate with Mobile Network Operators to Upgrade Existing Technology

Some features offered in connected cars are already available in luxury vehicles and aftermarket devices. However, in the next few years, the number of cars with built-in connectivity platforms is expected to substantially increase. As a result, automobile companies would be required to significantly upgrade their existing technological systems.

Historically, carmakers have controlled the different technologies offered in cars and partnered with hardware suppliers for the required infotainment systems. However, carmakers are finding it difficult to upgrade their technological systems, including developing and operating the software that enables the connectivity and functionality features of connected cars. Most vehicles currently have car-to-mobile connectivity. In the future however, cars are expected to include vehicle-to-vehicle and vehicle-to-infrastructure connectivity options.

Automobile companies and mobile network operators (MNOs) have started collaborating amid a rising demand for connected cars. Cellular connectivity in cars can be enabled in three different ways based on the SIM, communication module, and intelligence platform available in the car.

Embedded Solutions — The car has built-in connectivity and intelligence features.

Tethered Solutions — The driver uses a phone as a modem to enable wired or Wi-Fi connectivity.

Integrated Solutions — Smartphone applications are incorporated into the car to enable a driver to safely access features and services.

The automobile and mobile network industries are culturally different in several ways.

While the automobile industry is global, with almost all companies selling cars in a number of countries, the mobile network industry has a more regional/national focus. This makes it difficult for companies in these industries to partner with each other. However, as the demand for connected cars increases, carmakers and MNOs are expected to overcome these differences and collaborate.

Key Differences between Automobile and Mobile Network Industries

Mobile Network Industry		Automobile Industry
~40 years	**History**	~130 year
Local/Regional	**Reach**	Global
Short revenue and development cycles	**Industry Lifecycle**	Long development cycles
Extended relationship with customers	**Customer Relationship**	Transactional

Source: Aranca Analysis

Major global players offering connected cars with mobile connectivity to these cars are:

Automobile Companies:	Mobile Operators:
Audi, BMW, CHRYSLER, FIAT, Ford	at&t, Bell, China unicom 中国联通
GM, HONDA, HYUNDAI, JAGUAR	Deutsche Telekom, KDDI, kt
LAND-ROVER, mazda, Mercedes-Benz, NISSAN, RENAULT	docomo, ROGERS, SoftBank
PEUGEOT, Telstra, TESLA, TOYOTA	Sprint, TELECOM ITALIA, Telefónica
TURKCELL, vodafone, VOLVO, VW	

Key Challenges for Connected Cars

Connected cars offer several benefits over traditional cars in terms of safety, time and vehicle management, and entertainment. However, the adoption of and transition to these cars face various challenges.

1 Difference in Industry Lifecycles

The difference in lifecycles of the automobile and mobile network industries is one of the key challenges to impact the growth of connected cars. The mobile network industry constantly upgrades operating systems and new applications, whereas the automobile industry has longer lifecycles.

2 Software and Hardware Upgrades

Average product cycles in the automobile industry are significantly higher than those in the consumer electronics industry. Hence, carmakers are required to create a system wherein updates and product developments can be integrated through plug-and-play technologies without much effort several times during a car's lifecycle.

3 User-friendly Interfaces

Given that a large proportion of the elderly population would drive connected cars in the future, these cars should have user-friendly, easy-to-understand interfaces. In addition, carmakers would be competing with aftermarket products, which usually offer similar features at cheaper rates.

4 Security Concerns

Owners of connected cars regard cybersecurity as one of their biggest concerns. To attract new buyers, the automobile industry would have to provide security in connected cars that meet established global standards. Although unauthorized access and hijacking of cars are just theoretical threats at the moment, they could be a tangible threat in the near future. If a hacker breaks into a car's systems, he/she could seize control of the brakes or any other essential systems, resulting in potentially life-threatening scenarios for its passengers.

In 2014, McKinsey conducted a survey of 2,000 people in four countries (the US, Germany, Brazil, and China) and found that the market for connected cars is threatened by security and privacy concerns. According to the survey, 59% of people surveyed in Germany and Brazil strongly agreed to the statement, "I am afraid that people can hack into my car and manipulate it (e.g., the braking system), if the car is connected to the Internet." Furthermore, 51% and 45% of people in Germany and the US, respectively, strongly agreed to the statement, "I am reluctant to use car-related connected services because I want to keep my privacy", raising privacy concerns.

CyberSecurity Concerns Dominate Issues Related to Connected Cars

I am reluctant to use car-related connected services because I want to keep my privacy

Country	%
China	21%
Brazil	37%
US	45%
Germany	51%

I am afraid that people can hack into my car and manipulate it (e.g., the braking system), if the car is connected to the Internet

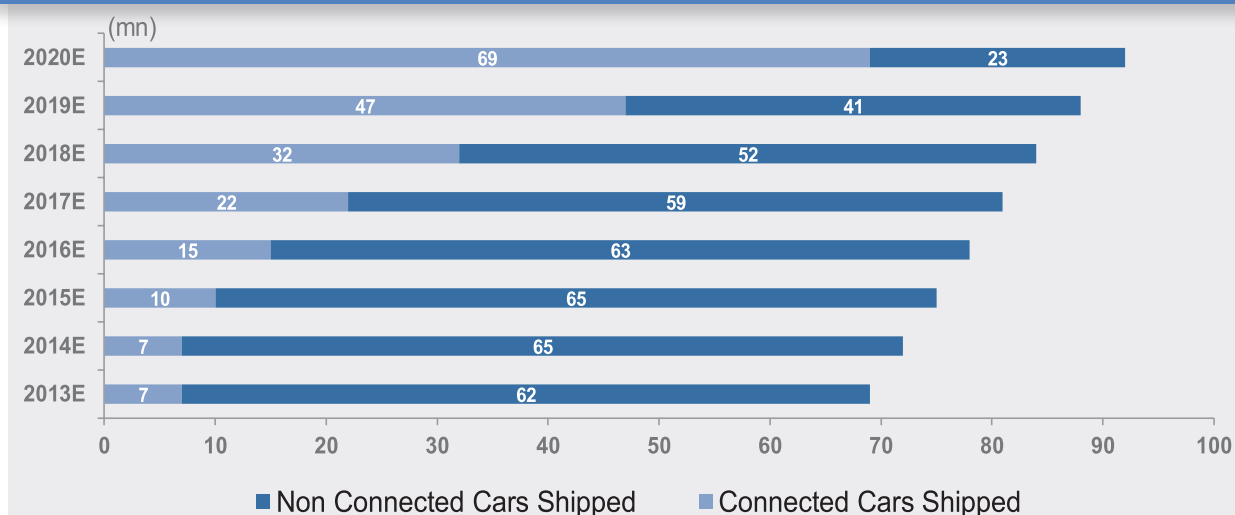| Country	%
China	53%
Brazil	59%
US	43%
Germany	59%
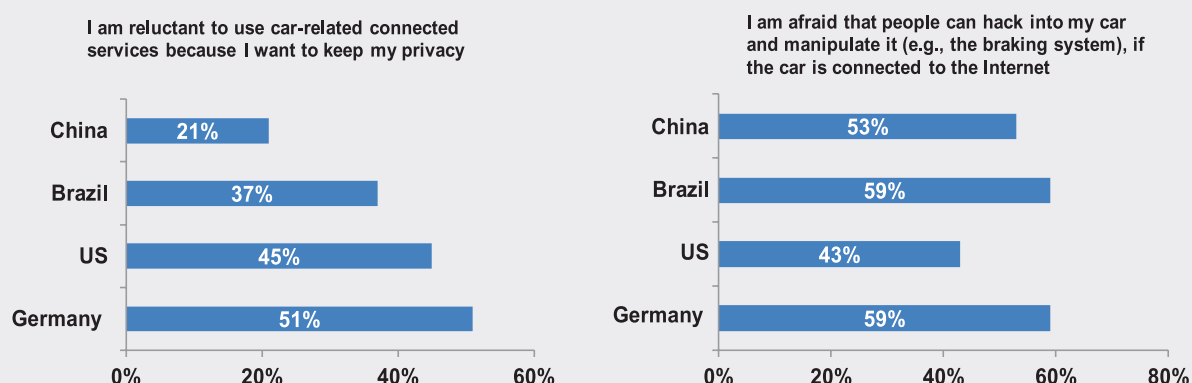
Source: McKinsey Survey

Connected Cars to Account for 75% of Global Car Shipments by 2020

Although connected cars are available in the market, they're predominantly part of the luxury segment. Several connectivity features are too expensive to be included in base models. Going forward, the growth of connected cars is expected to be a function of the cost and advantages/savings offered. Although the prices of connected cars could drop over the next few years as carmakers attain economies of scale, buyers would consider a cost-benefit analysis to determine if the advantages (safety features, lower maintenance costs, decline in insurance costs, fuel and time savings) justify the costs. As drivers realize the benefits of connected cars and their costs decline, we expect their sales to witness rapid growth.

According to BI Intelligence, the connected car market is expected to expand at a CAGR of 46% over 2014 – 20 to 69mn vehicles in 2020, nearly 10 times faster than the overall growth in car shipments. Moreover, the firm estimates connected cars to account for 75% of global car shipments by 2020. However, of the 220mn connected cars expected on global roads by 2020, just 88mn are expected to have active connectivity services.

Growth in Connected Car's Shipments Expected to Outpace Growth in Overall Car Shipment

(mn)	Non Connected Cars Shipped	Connected Cars Shipped
2020E	69	23
2019E	47	41
2018E	32	52
2017E	22	59
2016E	15	63
2015E	10	65
2014E	7	65
2013E	7	62

Source: BI Intelligence

The sales of connected cars are expected to be mainly driven by the young population (aged between 25 and 34 years) as well as increased demand from the US and Asian countries. The young population would find the features offered by connected cars appealing as they are more tech savvy and spend far more time in their cars than other age groups. Geographically, countries in Asia and North America are expected to drive the demand for connected cars, while the demand from Eastern Europe and South America is projected to be comparatively lower.

Higher Demand Likely from Young Customers

The young population's interest in technology makes them a key target group for connected cars. In-car entertainment technologies are expected to be a crucial factor with young buyers. According to PwC, buyers within the age group of 18 – 35 give higher importance to in-car technologies, such as access to apps and social media websites available on smartphones, than buyers among other age groups.

According to a survey conducted by GdK Research in six countries, young drivers are more likely to be attracted by the features of a connected car that people of higher age groups. The study revealed that in Germany, the UK, and US, 46% of drivers up to 34 years of age believe a "fully integrated in-car entertainment system" to be 'very' or 'extremely' appealing, significantly higher than drivers aged over 45 years (20%).

The results were more optimistic in Brazil, Russia, and China, with 55% of drivers with age below 34 years finding connected cars appealing versus 33% of drivers aged over 45 years. Moreover, the buyers below the age of 34 years spend more time in cars than other age groups. According to the survey, young buyers spend an average of 5 hours per week driving in developed markets compared with 4.6 hours for people aged over 45 years, while young buyers in developing markets spend 6.1 hours per week vis-à-vis 5.6 hours for people over 45 years.
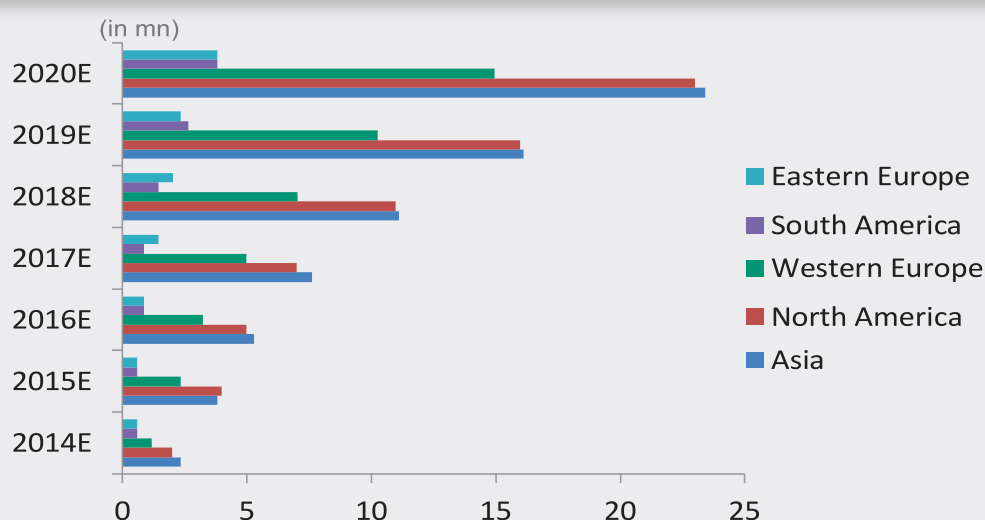
In a separate analysis, McKinsey found that 65% of drivers in the age group of 18 – 34 considered Internet connectivity as an important factor while purchasing a vehicle. This was substantially higher than 43% and 18% of people in the age group of 35 – 54 and 55 – 74, respectively.

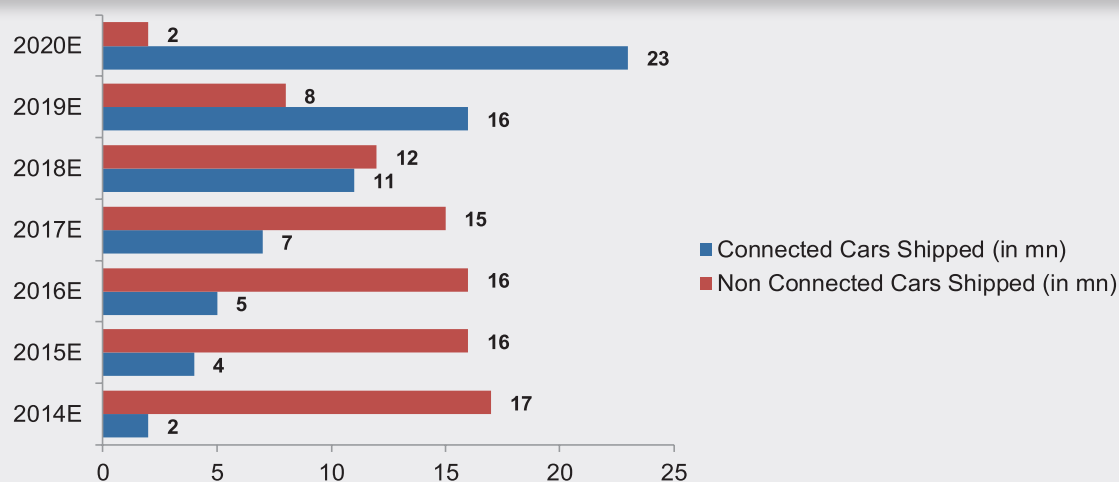## Asia and North America Expected to Boost Demand for Connected Cars

The growth in connected cars is estimated to outpace overall automobile growth in the next five years, led primarily by countries in Asia and North America (particularly the US).

Asia and North America to Drive Growth

(in mn)

Year	Asia	North America	Western Europe	South America	Eastern Europe
2020E	4	23	15		
2019E	2.5	16	10.5		
2018E	2	11	7		
2017E	1.5	7	5		
2016E	5	5	3		
2015E	4	4	2.5		
2014E	2.5	2	1		

Legend:
- ■ Eastern Europe
- ■ South America
- ■ Western Europe
- ■ North America
- ■ Asia

Source: BI Intelligence

Connected Car Shipments to Contribute Over 92% by 2020 in North America

Year	Connected Cars Shipped (in mn)	Non Connected Cars Shipped (in mn)
2020E	23	2
2019E	16	8
2018E	11	12
2017E	7	15
2016E	5	16
2015E	4	16
2014E	2	17

Legend:
- ■ Connected Cars Shipped (in mn)
- ■ Non Connected Cars Shipped (in mn)

Source: BI Intelligence

BI Intelligence expects connected car sales to rise at a CAGR of 50% in North America over 2014 – 20, led largely by higher demand in the US. Furthermore, 97% (20% as of 2014) of new car shipments in the US are expected to have Internet connectivity by 2020. Connected car sales in Asian countries are projected to increase at a CAGR of 47%, while sales in Eastern Europe and South America are anticipated to rise at a lower CAGR of 37% over 2015 – 20.

Companies Likely to Gain Maximum Benefit from Growth in Connected Cars

Several auto component manufacturers and electrical companies supply various hardware and software products that are essential in the development and production of connected cars. These products include things such as anti-theft systems, car-to-car interconnectivity platforms, sensors chips, automotive navigation products, software algorithms, digital networking processors, and semiconductors. As connected car sales gather momentum, we expect such companies to benefit immensely.

Some key companies that could profit from growth in the connected cars market include:

Delphi Automotive, which manufactures a range of products, including security anti-theft systems, high-performance and cost-effective connection systems, complex body electronics, electrical and electronic architectures, driver interface products with simple components and fully integrated systems, as well as powertrain and safety components for automobile companies.

TE Connectivity, which builds car-to-car interconnectivity platforms, sensors that recognize and transmit road conditions to other vehicles in the area, providing advanced warning of traffic and hazards. TE Connectivity's products help cars connect and communicate, resulting in higher safety.

Sensata Technologies, which provides pressure sensors, temperature control devices, and thermal circuit breakers for the aviation and automotive industries. The company's product portfolio also includes temperature, speed, position, and force sensors.

Garmin Ltd, which provides communications, navigation, and information devices using Global Positioning System (GPS) technology. The company offers a range of automotive navigation products.

Mobileye NV, which develops and manufactures system-on-chips, software algorithms, and customer applications for producers of driver assistance systems. Mobileye's ability to incorporate all object detection algorithms using a monocular camera configuration lowers cost and simplifies packaging and tooling of the camera sensor device.

Harman International, which offers lighting solutions, electronic systems, audio products, and digitally integrated infotainment and audio systems for the automobile industry

Gentex Corp, which provides automatic-dimming rearview mirrors and electronics to the automobile industry. The company sells auto-dimming automotive rearview mirrors that dim according to the headlight glare from trailing vehicles.

Freescale Semiconductor, which offers digital networking processors, automotive microcontrollers, as well as semiconductors for communications, networking, and automotive applications.

NXP Semiconductors NV, which provides semiconductor product solutions used in a range of automotive, identification, wireless infrastructure, lighting, industrial, mobile, consumer, and computing applications.

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