FAST 2030
FUTURE AUTOMOTIVE INDUSTRY STRUCTURE UNTIL 2030
THE IMPACT OF CURRENT TRENDS ON VALUE CREATION
AND THEIR IMPLICATIONS

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Prepared for: Cluster de Automoción de Navarra
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Section 0 | Introduction to Oliver Wyman
Introduction to Oliver Wyman

Oliver Wyman Group is a Marsh & McLennan company, one of the leading global professional services firms.

**OLIVER WYMAN GROUP**
Management, economic and brand strategy consulting
- Strategy
- Organization
- Operations
- Risk management
- Transformation management

- **1984** year founded
- **4,700** colleagues
- **60+** offices worldwide
- **$1.9 BN** 2017 revenue

**GUY CARPENTER**
Risk and reinsurance specialist
- Reinsurance and risk management
- Contract management, claims handling, and fiduciary accounting

- **1922** year founded
- **2,300** colleagues
- **50+** offices worldwide
- **$1.2 BN** 2017 revenue

**MERCER**
Talent, health, retirement and investment consulting
- Personnel strategy
- HR systems
- Compensation
- Incentive systems
- Communication

- **1937** year founded
- **22,600** colleagues
- **170+** offices worldwide
- **$4.5 BN** 2017 revenue

**MARSH**
Insurance broker and risk advisor
- Risk management, consulting, and transfer
- Financial solutions and insurance program management services

- **1871** year founded
- **32,700** colleagues
- **500** offices worldwide
- **$6.4 BN** 2017 revenue

**MARSH & McLennan Companies**
- **2017 Revenue: US$14 BN**
- **Staff: 65,000+**
- **Clients in more than 130 countries**
- **New York Stock Exchange (MMC)**
Oliver Wyman Group overview
Oliver Wyman Group has ~4,700 colleagues with expertise across a range of industries to help our clients address their greatest challenges.
Presence at international forums
We lead international discussions on key topics at game-changing events and international forums
Oliver Wyman’s Global Automotive Practice

Oliver Wyman is working for the world´s leading car manufacturers and suppliers on a broad range of topics

Automotive manufacturers
(passenger cars, commercial vehicles)

- Extensive project experience at leading global OEMs
  - BMW
  - Daimler
  - Volkswagen Group
  - Peugeot/Citroën
  - GM
  - Ford
  - Renault
  - ...
- Intensive contacts with top management
- Broad coverage of topics:
  - Sourcing / product costs
  - R&D strategy / core competences
  - Assembly processes
  - Risk management
  - Customer satisfaction
  - Distribution network
  - Marketing
  - Brand management
  - Service strategy
  - Financial services
  - ...

Automotive suppliers

- More than 200 projects since 2004 and more than 80 active clients:
  - Nine of the top 20 companies
  - Medium-sized & family companies
- Very good relations with top management and owners
- Broad coverage of topics and modules:
  - Strategy, market analyses & market entry, footprint optimization, product portfolio, M&A, brand management, sourcing, operational excellence, reorganization & restructuring, performance improvement, product cost reductions, supply chain optimization, benchmarking, ...
  - Engine, transmission, chassis, interior, body, exterior, electrical systems/ electronics, engineering services, ...

Source: Oliver Wyman
Oliver Wyman Automotive service offering
Together with our clients we develop innovative strategies and viable solutions for the main challenges of the automotive industry

<table>
<thead>
<tr>
<th>Research &amp; Development, Product and Brand</th>
<th>Purchasing</th>
<th>Production</th>
<th>Sales &amp; Marketing</th>
<th>After Sales, Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Brand strategy and management</td>
<td>• Parts, components and systems</td>
<td>• Footprint evaluation</td>
<td>• Sales</td>
<td>• Financial services</td>
</tr>
<tr>
<td>• Product portfolio and product strategy</td>
<td>• Material</td>
<td>• Manufacturing technology and investment strategy</td>
<td>• Wholesales, retail</td>
<td>• Service and parts</td>
</tr>
<tr>
<td>• Innovation management</td>
<td>• Production equipment</td>
<td>• Production planning</td>
<td>• Distribution</td>
<td>• Fleet</td>
</tr>
<tr>
<td>• R&amp;D</td>
<td>• Supply chain management</td>
<td>• Shop floor optimization and indirect functions</td>
<td>• Marketing</td>
<td>• Other services</td>
</tr>
<tr>
<td>• Product development process</td>
<td>• Sourcing strategies</td>
<td>• Launch and ramp-up management</td>
<td>• Growth strategies and programs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quality management</td>
<td>• Customer satisfaction and customer loyalty</td>
<td></td>
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</tbody>
</table>

Cross-functional topics
Corporate strategy, Product costs, Quality and warranty, make or buy, core competencies, organizational redesign, partnerships / M&A, task forces

Source: Oliver Wyman
Introduction to The Harbour Report® Automotive

The Harbour Report® is the leading global Automotive manufacturing benchmarking study

• Harbour Report® basics

• Guide to competitive analysis in manufacturing performance based on ~ 400 plants globally. Providing insights per shop, function and sourcing type by company, plant and product

• Benchmarking data enables participants to focus improvement activities in numerous areas with highest potential for savings (cost, product design, manufacturing performance, etc.)

• Over 30 years of proven methodology ensures comparability
  – Detailed definitions
  – Adjustments for sourcing

• The Harbour Report® team as a trusted source of information and as a common platform for Automotive manufactures

Source: Oliver Wyman
Proprietary Intellectual Capital
Oliver Wyman develops and applies innovative, leading-edge intellectual capital, especially in the area of value growth strategies.

Periodicals
Automotive Manager 2017
Perspectives on Manufacturing industries 2017

Studies and Industry Reports
Digital Industry
Mobility 2040
Visibility and Control
FAST 2030

Point of View
Digitization of Manufacturing Sales
Robotics and Industrial Automation Systems Market Study
E-Mobility 2035
Making money with car service platforms

Source: Oliver Wyman
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Section 1

Excerpt from FAST 2030 study for ACAN
FAST 2030
Study outline

Outline

• The automotive industry remains on track for success – in continuation of the recent years. After the crisis years 2008–10, both OEMs and suppliers have experienced a phase of prosperity.

• However, this might turn out to be a short-lived chapter in light of the “Mighty Seven Industry Trends” – a perfect storm of transformative technologies and changing customer behavior – which challenge the core business pillars the industry is built on.

• As a consequence, the shape of automotive value creation is expected to simultaneously shift in three dimensions until 2030 – horizontally between vehicle systems, vertically between industry players, and regionally.

• Nine new business models are emerging for auto suppliers creating a need to re-define their role and operating model in order to retain competitiveness.

• In parallel, both suppliers and vehicle manufacturers will have to foster holistic performance improvements to offset the needed investments and absorb other looming externalities.

Sources

This is the third edition of the FAST study, created every five years in collaboration between Oliver Wyman and the German Automotive Association (VDA).

• More than 100 expert interviews with global top managers in the automotive industry as well as further external industry specialists.

• Triangulation of a vast set of market publications, industry reports, and other external sources to gather additional both quantitative and qualitative insights on current and future developments.

• Insights from Oliver Wyman’s global internal expert network, knowledge repository and recent intellectual proprietary on industry dynamics and transformative trends (amongst others, “E-Mobility 2035 study”, “Mobility 2040 study”, “HMI point of view”)

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Agenda FAST 2030

1. **Status:** Current status of the automotive industry
2. **Trends:** Current and emerging trends changing the automotive industry
3. **Value:** Automotive value creation development until 2030
4. **Impact:** Areas of impact and strategic business model options for automotive suppliers
STATUS:
Current status of the automotive industry
Current status of the automotive industry – Overview

Overall, the automotive industry remains strong and continues to grow; suppliers are well positioned, but the road ahead is challenging.

<table>
<thead>
<tr>
<th>1</th>
<th>Strong global growth of the automotive industry</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Light vehicle production has grown to ~95 mn vehicles in 2017</td>
</tr>
<tr>
<td>+3%</td>
<td>CAGR (2010-2017)</td>
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</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Regional value shifts in key markets</th>
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<tbody>
<tr>
<td></td>
<td>Emerging markets have been the key growth drivers with China leading at…</td>
</tr>
<tr>
<td>+15%</td>
<td>CAGR (2005-2017)</td>
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<table>
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<tr>
<th>3</th>
<th>Pressure both from need for increased customer value and on prices</th>
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<tbody>
<tr>
<td></td>
<td>Concurrently, products have become more complex at unchanged price levels</td>
</tr>
<tr>
<td>x1.6</td>
<td># PATENTS (2008-2016)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Healthy profit margins for suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Despite the tension, suppliers have shown sound financial performance</td>
</tr>
<tr>
<td>7%</td>
<td>EBIT MARGIN (average, 2015)</td>
</tr>
</tbody>
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<table>
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<tr>
<th>5</th>
<th>…but increasing challenges for suppliers emerge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disconnect between growth, new tech, and organizational readiness manifests in multiple issues such as quality</td>
</tr>
</tbody>
</table>

Source: Oliver Wyman analysis
The automotive industry – Historic trajectory
Despite some crises, the auto industry has been on a strong growth path for over 100 years with an especially strong recovery after the financial crisis...

Global light vehicle production development
In MM units, light vehicles, 1900–2017

Comments

• Since 2012, the publish date of the FAST 2025 study, market growth has persisted

• In total, global light vehicle (LV) production grew steadily with a CAGR of 3% between 2010 and 2017

• Largest LV producers are China, the United States, Japan, and Germany, accounting for 59% of total vehicle production

• Passenger cars account for approx. 75% of LV production, commercial vehicles for the remaining 25%

• The momentum of automotive industry growth is expected to continue over the next years
Regional development
Key growth markets, especially China, are still the engines driving overall growth and the ongoing regional shift of the automotive industry

World light vehicle production
In MM vehicles

Source: LMCA Q2/2017 and Q1/2012

1. RoW includes Australia and Iran (amongst others)
Regional development – OEM production plants expansion in China

In China, the number of OEM production plants increased by more than a third since 2012, raising production capacity by about 50%.

Overview of OEM production plants in China
# production plants by region, 2012 vs. 2017

Central south [13%]
Central south remains important production location, although the region experienced relative low growth in new OEM plants compared to other regions.

Southwest zone [21%]
With more than 15 individual car manufacturers located in in Southwest industrial zone, the cluster is in pole position in terms of production output.

Pearl River delta [11%]
Very high growth in OEM production plants (almost 60% since 2012) given highly beneficial infrastructural location at the South China Sea.

Northeast zone [10%]
The number of OEM production plants in Northeast China increased only slightly since 2012 (<20%), accounting for 10% of total Chinese vehicle production in 2017.

Bohai zone [15%]
Bohai zone in North China with limited number OEM production plants – often with rather large volumes; More than 50% of the industrial clusters’ plants are directly located either in Beijing or Tianjin.

Yangtse delta [19%]
Due to its favorable location at the Yellow and East Chinese Sea, East China is one of the leading regions in terms of number of OEM production plants and output.

% of total Chinese vehicle production 2017
# of OEM production plants 2012 (inner circle) vs. 2017 (outer circle)
Source: Automobil Produktion, LMCA Q1/2018, Oliver Wyman analysis

Concentration and main expansion of OEM production plants in regional clusters along the coastline.
3. Continuing crunch of increasing customer value vs. price pressure.
Largely unchanged environment of customer spending

Share of annual income spent on vehicle purchases
2011–2015¹, avg. income per household in local currency

United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Remaining average income</th>
<th>Amount of income spent on vehicle purchases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>2012</td>
<td>95%</td>
<td>5%</td>
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<tr>
<td>2013</td>
<td>95%</td>
<td>5%</td>
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<tr>
<td>2014</td>
<td>94%</td>
<td>6%</td>
</tr>
<tr>
<td>2015</td>
<td>95%</td>
<td>5%</td>
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</table>

Germany

<table>
<thead>
<tr>
<th>Year</th>
<th>Remaining average income</th>
<th>Amount of income spent on vehicle purchases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>97%</td>
<td>3%</td>
</tr>
<tr>
<td>2011</td>
<td>97%</td>
<td>3%</td>
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<td>2012</td>
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<td>97%</td>
<td>3%</td>
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</tbody>
</table>

China²

<table>
<thead>
<tr>
<th>Year</th>
<th>Remaining average income</th>
<th>Amount of income spent on vehicle purchases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
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</tr>
<tr>
<td>2011</td>
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<td>15%</td>
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<tr>
<td>2012</td>
<td>82%</td>
<td>18%</td>
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<tr>
<td>2013</td>
<td>81%</td>
<td>19%</td>
</tr>
<tr>
<td>2014</td>
<td>81%</td>
<td>19%</td>
</tr>
<tr>
<td>2015</td>
<td>81%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Increase mainly driven by a higher penetration rate of vehicles/households (0.04 vs. 0.06 vehicles sold/household between 2011 vs. 2015)

Despite increasing value of cars due to new technologies and functionalities as well as advanced electronics, households’ spending behaviour for vehicle purchases has remained unchanged.

¹. Most recent data available per country
². Total = amount of income spent on transport and communication

Source: Bureau of Labor Statistics, Statistisches Bundesamt, China Statistical Yearbook, LMCA Q2/2017, OECD, Oliver Wyman analysis
Supplier performance (Jan 2017)

With the OEM’s common platform/part strategy, and despite a challenging environment, suppliers were able to show a healthy financial performance.

**PROFIT AND LOSS STATEMENT**

- **Revenue Growth**: 4.9%
- **EBITDA Margin**: 11.9%
- **EBIT Margin**: 7.2%
- **ROCE**: 20.7%

**BALANCE SHEET**

- **Equity Ratio**: 38.9x
- **Net Debt/EBITDA**: 1.1x

**CASH FLOW**

- **Inventory Turnover**: 12.6x
- **Cash Creation**: 0.05x

1. Change in Net Cash (average liquid minus financial debt) in relation to working capital at period end

Note: Suppliers with KPI variance greater than three standard deviations from mean have been omitted

Source: Oliver Wyman Supplier Benchmarking Database, company reports, Oliver Wyman analysis

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First struggles of the automotive industry

Given strong business growth, many suppliers were slow at adapting their organizational model simultaneously risking system and efficiency problems.

**Organizational complexity**

*Degree of organizational complexity*
(approximated by company revenues and number of business units (BUs))

- **€10–35 BN**
  - 5–10 BUs
  - Maturity insufficient to manage complexity
- **€5 BN**
  - 3–4 BUs
- **<€800 MM**
  - 1–2 BUs
- **<€250 MM**
  - 1–2 BUs

**Insight**

- Most suppliers were “born” by creating a single product or having a single business line.
- Along with organic growth or via M&A, suppliers developed in several different domains by expanding their portfolios and OEM applications, growing their client lists, moving from low-end to high-tech products, and going global.
- Consequently, complexity has risen dramatically in many organizations.

Many of the suppliers were hesitant to perform fast and bold enough modifications in their organizational structure needed to efficiently manage new types of challenges.

Source: Oliver Wyman Supplier Best Practice Benchmarking
TRENDS:
Current and emerging trends changing the automotive industry
The Mighty Seven – Automotive industry trends until 2030
Seven fundamental trends drive the automotive industry until 2030, enabled and accelerated by Digitalization, AI and Machine Learning

- **CONNECTED VEHICLE**: Additional safety and (services) revenues through increasing connectedness
- **AUTONOMOUS VEHICLES**: Progression of today’s partially automated driving into fully driver-less vehicles
- **E-MOBILITY**: Increasing electrification of powertrains, resulting in decreasing penetration of ICEs
- **HUMAN-MACHINE-INTERFACE**: New and digitized control concepts for driver/car interaction
- **CHANGING CUSTOMER STRUCTURE**: Partial replacement of individual vehicle buyers by large fleet or group buying driven by mobility-on-demand services
- **CREATION**: Provision of selected vehicle features as pay-per-use for certain target groups of vehicle owners
- **DIGITAL INDUSTRY**: Increasing digitization of processes through predictive and adaptive data capability

Source: Oliver Wyman analysis
Changing customer structure

**TREND**

- Increasing shift from vehicle ownership to usership ("mobility on demand")
- New mobility fleet operators enter the market and increasingly replace individual vehicle buyers

**DRIVERS**

**IMPACT ON VALUE CREATION**

Value creation per vehicle module (2017)

Key potential impact on:

- **Overall vehicle design** to be more robust/low-maintenance, and less safe (for AD vehicles only)
- **Vehicle interior** to be more functional to meet customer usage patterns (e.g. robust materials, self-cleaning systems)

Source: Oliver Wyman study "Mobility 2040", Oliver Wyman analysis
Changing customer structure – Automotive value chain under attack

Meanwhile, new mobility players are pushing into the automotive value chain and continuously replacing more individual vehicle buyers.

Changing customer needs lead to disruptions in the mobility ecosystem…

...and the emergence of new mobility providers

Mobility players enter the market at the customer interface

Changing customer needs lead to disruptions in the mobility ecosystem...

• ...part of the connected life and host for digital activity and consumption
• ...connected device and valuable data generator
• ...shared good and key part of mobility
• ...a digitally purchased and maintained good

Source: Oliver Wyman analysis

OEMs increasingly investing in mobility services to find new usage models for cars:

- **Daimler (2017)**: Invest in Via (ride-hailing) and Turo (peer-to-peer car sharing)
- **Volkswagen (2016)**: Foundation of MOIA to offer own mobility services (ride-hailing)
- **GM (2016)**: Invest in Lyft (ride-hailing)
- **BMW (2016)**: Invest in Scoop (carpool platform)
New distribution channel pay-per-use

**TREND**
- Customers ask for individualized, selective, on-demand mobility and service solutions, captured by pay-per-use business models
- These business opportunities occur in a variety of vehicle modules, opening up new revenue generation models

**DRIVERS**
- Customer preferences
- Technology

**TREND REALIZATION**
- Potential development pay-per-use
  - Pay-per-use functions/services are technically feasible and envisioned
  - Pay-per-use will be implemented in specific, best suitable (sub-)modules
  - Pay-per-use functions/services become more the rule than exception

**IMPACT ON VALUE CREATION**
- Value creation per vehicle module (2017)
- Key potential impact on:
  - **Interior functions**, e.g. massage, park assistant and 3D sound
  - **Performance features**, e.g. add. HP/kW and battery range extension
  - **Exterior functions**, e.g. infrared/laser light, rain sensor

Source: Oliver Wyman analysis

© Oliver Wyman
New distribution channel pay-per-use
The interplay of increasing pay-per-use penetration and thus, component requirements, will significantly affect suppliers’ cash flows.

Potential development of pay-per-use and value creation impact
Exemplary cost and revenues for one pay-per-use feature

- By incorporating components that allow pay-per-use features, total cost per vehicle would increase, while no revenues are generated at vehicle sale unless negotiated as higher fixed prices to the OEM upfront.
- With increasing penetration in new vehicles sales, cost per component could decrease through economies of scale/standardization/lower variability.
- However, revenues and finally profits from pay-per-use are highly dependent on customer acceptance, the consequent adoption rate and OEMs willingness to pass-through pay-per-use revenues.
- Additionally, cash flows would differ significantly compared to today as revenues are generated only when customers are using features.

Revenues from pay-per-use features may lack behind implementation depending on customers’ adoption rate.

Illustrative

Source: Oliver Wyman analysis
**TREND**

- Digitization of processes through predictive and adaptive data capability:
- **Digitization and optimization** of core processes to support target customer experience
- Build up of superior data analytics, machine learning and “big data” competencies to deliver one holistic customer-centric experience

**DRIVERS**

- Customer preferences
- Technology

**TREND REALIZATION**

Development of the industrial era

- **1.0** Usage of water- and steam-power for mechanical manufacturing
- **2.0** Electrically-powered mass production based on the division of labor
- **3.0** Leverage of electronics and IT to achieve further automation of manufacturing
- **4.0** Cyber-Physical Systems to integrate production systems as well as product and production process

**IMPACT ON VALUE CREATION**

“Digital industry” potential in 2030
Margin impact¹

- Idea-to-produce
- Sales-to-delivery
- Operations and services

- **5%** Average impact relative to industry revenue in 2030

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¹ Gross effect not including downside, basic production efficiency and pricing effects as well as specific business case considerations (i.e. investments); Value spaces were estimated based on industry-specific cost structures and were applied on approximated global value creation in 2030 (GDP growth assumed); Source: Oliver Wyman “Digital Industry” study

© Oliver Wyman
Digital industry
Driven by changing customer preferences and new technical solutions, the “Digital Industry” is gaining ground

Changing customer preferences
- Product individualization
- Permanent connectivity
- Personalization through Big Data
- Product as a service
- Hassle-free solutions
- Willingness to share data

Digital automotive industry
- Idea-to-produce
- Sales-to-delivery
- Operations and services

Technical enablers
- Data availability
- Declining technology costs
- Mechanical development progress
- Accelerating innovation cycles
- New production techniques
- Changing R&D patterns

Source: Oliver Wyman analysis
E-Mobility – Overview

**TREND**

- Electrified vehicles are emerging as alternative powertrains to the internal combustion engine

**TREND REALIZATION SCENARIOS**

Ramp-up new EV sales 2015–2030 (%)

**IMPACT ON VALUE CREATION**

Value creation per vehicle module (2017)

Main impact on:

- **Complete powertrain**, replacing combustion engine with fuel tank and exhaust system by battery with electric infrastructure
- **Electrics/electronics systems** related to E-Mobility (e.g. BMS and battery wiring)

Source: Oliver Wyman analysis
E-Mobility – Drivers

How fast suppliers have to transform their portfolio and capabilities depends on the speed of market penetration which is driven by five major factors:

**LEGISLATIONS/REGULATIONS**
- Legislation and incentives
- Environmental concerns
- Fuel independence
- Sustainable mobility

**COMPETITORS**
- Brand and innovation strategy
- Product and service offerings
- Costs and investments needed

**INFRASTRUCTURE**
- Energy availability
- Charging infrastructure
- Technological compatibility
- User friendliness

**DRIVING FORCES FOR E-DRIVETRAIN ADOPTION**

**CONSUMERS**
- B2B: Business strategy and long-term cost reduction
- B2C: Environmental awareness and preference for “green” modes of transportation
- Sharing economy
- Fleet management

**TECHNOLOGY/COST**
- Energy storage capabilities and fuel economy
- Performance and cost of new technologies
- Connection to Smart Home

Source: Oliver Wyman analysis
E-Mobility – Legislation and regulation

Regulatory interventions intensify and clearly reveal a three-stage agenda towards a comprehensive powertrain electrification within the next decades.

### Electric powertrain market activation (2020)
- Make BEVs attractive
  - Exemption of EVs from licence plate lottery and registration fees
  - "Zeo-tax" for "zero-emission" regulation
  - Reduction of important duties for EVs
  - Cancellation of "10 hour charging rule"
- Specification of subsidy standards – only BEV with Chinese battery
- Option driving ban for diesel cars in big cities without approval of "Bund"
- Implementation WLTP
- 53 changes in incentive system in 2017
- NEMMP with goal 400,000 electric vehicles by 2020
- Beschluss über neue „leise Autos“ Vorschrift

### Electric powertrain market penetration (2025)
- Make ICEs unattractive
  - Implementation WLTP
  - New Bharat Stage VI standard from 2020
  - Introduction Euro IV-Standard
  - Specification of subsidy standards – only BEV with Chinese battery
  - Option driving ban for diesel cars in big cities without approval of "Bund"
  - Reduction of important duties for EVs
  - Cancellation of "10 hour charging rule"
  - Specification of subsidy standards – only BEV with Chinese battery
  - Option driving ban for diesel cars in big cities without approval of "Bund"
  - Reduction of important duties for EVs
  - Cancellation of "10 hour charging rule"
- National emission reduction in 2025 compared to 2020/21
- Country wide introduction China VI (a) from 2020, (b) from 2023
  - 50% electric cars to comply with Paris climate goals by 2035
  - Complete ban ICE by 2030
  - Complete ban ICE ab 2040
- Complete ban ICE by 2030
- Non-binding goal 100% sales of EVs by 2030

### Electric powertrain market solidification (2030)
- Eliminate ICEs
- Complete ban ICE by 2030
- Complete ban ICE ab 2040
- 50% E-cars to comply with Paris climate goals by 2035
- ICE sales ban from 2040
- Non-binding goal 100% sales of EVs by 2030

1. Statement, Climate Action Tracker Report* with impact on all member states of Paris climate agreement

Source: ICCT; diesel.net; Press; Oliver Wyman analysis
E-Mobility – Technology and cost

Technological progress and decreasing costs will accelerate breakthrough of E-mobility within next decade

Forecast development of key technological parameters for E-mobility

- **Range increase** – as one key purchasing criteria for consumers – is **technological focal area** for OEM and battery manufacturers
- Current developments promise **50–100% increase of energy density**
- Additional long-term potential through new technologies post 2025 likely (e.g. solid-state, LiAir)
- In parallel, **battery cost will decrease** continuously through new materials, processes and process automations along with new/lighter cell designs and higher production volumes (“economies of scale”)

Source: Merrill Lynch; Oliver Wyman analysis
E-Mobility – Competition

Car manufacturers have different electrification strategies depending on their vehicle class specific product portfolio

Different adoption paths for different vehicle classes over time

ICE = Internal Combustion Engine; HEV = Hybrid Electric Vehicle; PHEV = Plug-in Hybrid Electric Vehicle; REEV = Range-Extended Electric Vehicle; BEV = Battery Electric Vehicle; FCEV = Fuel-Cell Electric Vehicle
1. Including micro and mild-hybrid
Source: Oliver Wyman analysis
E-Mobility – Electrification scenarios
As such exist very different ramp up scenarios depending on specific level of governmental legislation and incentives

Forecast of new EV-sales 2015–2035
%

Archetype 1: Strong legislation
Complete ban of ICE at specific point in time

Archetype 2: Urban legislation and incentives
City bans or tolls for ICEs + other incentives for urban areas

Archetype 3: Focus on incentives
Focus on different market incentives to influence customer behaviour

Archetype 4: No further legislation or incentives
No further incentives and legislative support

Source: Oliver Wyman “E-Mobility 2035” study
Autonomous vehicles – Overview

**TREND**

- Advanced driver assistance systems are already reality and allow the owner to hand over “driving” to the vehicle in certain situations.
- Partially automated (L2) driving will progress into fully automated (L5) in the long run.

**IMPACT ON VALUE CREATION**

Value creation per vehicle module (2017)

**TREND REALIZATION**

New autonomous vehicle sales (# LV)

- Base case: Automation Level 2/Level 4
- Best case: Automation Level 2/Level 4
- Worst case: Automation Level 2/Level 4

**DRIVERS**

- **Safety**
- **Comfort**

1. Level 2 = Partial automation, where drivers still have to monitor the system at all times but systems takes over control in specific use cases; Level 4 = High automation, i.e. driver is not required during defined use case; Source: a16z, NHTSA, SAE, Oliver Wyman analysis

**Main impact on electric/electronics systems:**

- **Sensors** (incl. camera, radar etc.)
- **Information and communication** (maps/V2X communication)
- **Actuation**
- **Control unit** (“Intelligence”)
Autonomous vehicles – The evolution has already begun

Autonomous driving is still in early stages but is expected to reach full automation levels between 2025 and 2030

Now

- Driver is continuously exercising longitudinal and lateral control

Now/NEAR

- Driver has to monitor the system at all times
  - Lateral or longitudinal control is accomplished by the system
  - System has lateral and longitudinal control in a specific use case

~ 2020

- Driver does not have to monitor the system at all times. Must always be in a position to resume control

~ 2025

- Driver is not required during defined use case

2025/30

- System can cope with all situations automatically during the entire journey.
  - No driver required

Level 0 - Driver Only

Level 1 - Assisted

Level 2 - Partial Automation

Level 3 - Conditional Automation

Level 4 - High Automation

Level 5 - Full Automation

Source: NHTSA, SAE, Oliver Wyman analysis
Autonomous vehicles – ‘Big players’ moves
Big digital giants have already announced the introduction of self-driving vehicles in the near future

Tech-companies with deep pockets are pushing for fully automated vehicles…

<table>
<thead>
<tr>
<th>Company</th>
<th>Market introduction</th>
<th>Main partners</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>~2020</td>
<td>Fiat, Chrysler</td>
<td>US</td>
</tr>
<tr>
<td>Tencent</td>
<td>~2020</td>
<td>Foxconn, Harmony</td>
<td>China</td>
</tr>
<tr>
<td>Apple</td>
<td>~2021</td>
<td>-</td>
<td>US</td>
</tr>
<tr>
<td>Baidu</td>
<td>~2021</td>
<td>Unconfirmed</td>
<td>China</td>
</tr>
</tbody>
</table>

...while traditional automakers focus on a evolutionary step-by-step approach with partly less ambitious targets

<table>
<thead>
<tr>
<th>Company</th>
<th>Market introduction</th>
<th>Main partners</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>NISSAN</td>
<td>~2018</td>
<td>-</td>
<td>Japan</td>
</tr>
<tr>
<td>BMW</td>
<td>~2021</td>
<td>Intel, Conti Mobileye, Nvidia</td>
<td>Germany</td>
</tr>
<tr>
<td>VOLKSWAGEN</td>
<td>~2019</td>
<td>LG, Quanergy, Bosch</td>
<td>Germany</td>
</tr>
<tr>
<td>TOYOTA</td>
<td>~2020</td>
<td>Several Universities, Microsoft</td>
<td>Japan</td>
</tr>
</tbody>
</table>

1. Thomson Reuters on 30th of August, 2016 – exchange rates of same day; 2. New start-up under the name Future Mobility; 3. Only for restricted cities and highways; 4. Unconfirmed activity 5. BMW iNext promises level 3 and level 5 autonomy option. The former will be more likely; 6 Including Audi with introduction of A8 with level 3 autonomy beginning of 2019
Source: Thomson Reuters, Faktiva, Forbes, Company websites, Oliver Wyman analysis
Human-Machine-Interface (HMI)

**TREND**

- Technological advancements and consumer pull for convenience and comfort will further drive the shift from analog to more intuitive and augmented HMI technology

**DRIVERS**

- CUSTOMER EXPECTATION
- DIGITALIZATION

**TREND REALIZATION**

Automotive HMI market, 2017 vs. 2030 (in € BN)

<table>
<thead>
<tr>
<th>Year</th>
<th>Instrument cluster</th>
<th>Center stack display</th>
<th>Multi-Fu buttons, controllers, touchpads</th>
<th>Steering wheel controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>$20.7$</td>
<td>$20.7$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>$35.8$</td>
<td>$20.7$</td>
<td></td>
<td>$+4%$ CAGR</td>
</tr>
</tbody>
</table>

**IMPACT ON VALUE CREATION**

Value creation per vehicle module (2017)

- **+19% CAGR**
  - Proximity/gesture/voice recognition: Fast growing, but smallest HMI market

- **+15% CAGR**
  - Head-up displays (HUD): Fast growing segment, becoming the fourth largest HMI market by 2030

- **+5% CAGR**
  - Center stack display: Moderately growing, becoming the largest HMI market by 2030 (joint pole position with instrument cluster category)

**Main impact on cockpit through ongoing digitalization:**

- (Central stack) displays
- Multifunctional controls
- Digital instrument cluster
- HUDs
- …
HMI – Increasing demand for comfort and connectedness
Currently emerging technologies are expected to reach > 50% penetration already before 2030; ongoing digitalization of controls and instruments

Penetration rate of HMI technologies
In % of total vehicles, 2017–2030

<table>
<thead>
<tr>
<th>Technology</th>
<th>2017 Penetration (%)</th>
<th>2030 Penetration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center stack hardkeys &amp; buttons</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>MuFu controller</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Touchpads</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Digital IC</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Digital/analog IC</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Analog IC</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Non-touch CSD</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Touch CSD</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Steering wheel controls</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Windscreen HUD</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Combiner HUD</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Augmented reality</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Speech recognition</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Proximity/gesture recognition</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Comments
- The future cockpit will deliver an increasingly intuitive, innovative and personalized user experiences
- This next-generation HMI is expected to prevail until 2030, smartly combining voice control, touchscreens and conventional controls depending on application and passengers
- Development will be fueled by ongoing vehicle automation, and – predominantly – the achievement of critical mass together with increasing functions/components integration

Note: MuFu = Multi-Function, CSD = Center stack display, IC = Instrument cluster, HUD = Head-up display
Source: Oliver Wyman HMI Point of view
HMI – Non-auto players enter the market
Increasing importance of electronics and automated systems attracts non-auto technology experts – competition for traditional suppliers increases

Large established player

Startups

Digital giants

Google

NVIDIA

Samsung

LG

Consumer electronics players

Technology specialists

Example – non-exhaustive

1. Samsung, already involved in automotive through Renault Samsung Motors, is creating a new automotive components team specialized on infotainment and autonomous driving

Source: Oliver Wyman HMI Point of view
Connected vehicle

**TREND**
- **Urbanization** and the demographic change put “digital natives” in the driver seat
- Consumer expectations shift, making individualization and convenient device/service integration key
- Further, continuous smart device and mobility availability is fueled by the rate of change of converging industries

**DRIVERS**
- Urbanization
- Digitalization
- Demographic change

**TREND REALIZATION**
Penetration rates of embedded connectivity units in LV production

- 2017: 61%
- 2030: ~80%

**IMPACT ON VALUE CREATION**
Value creation per vehicle module (2017)

Main impact by creating add-on connected services, such as:
- Telematics-enabled insurance services
- Fleet management services
- Safety and remote services

Source: Oliver Wyman analysis
Connected vehicle – Battlefield for revenues and customer access
Consequently, many players of the connected car ecosystem are getting into position with a focus on entering and monetizing (data-based) services.

Exemplary companies

<table>
<thead>
<tr>
<th>Automotive OEMs</th>
<th>Suppliers</th>
<th>Mobile device players</th>
<th>(Operation) software players</th>
<th>Network operators</th>
<th>Web service companies</th>
<th>Independent aftermarket players</th>
<th>Fleet operators</th>
<th>Bank, finance and insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAIMLER</td>
<td>Valeo</td>
<td>BOSCH</td>
<td>Continental</td>
<td>TE</td>
<td>SAMSUNG</td>
<td>Apple</td>
<td>Android</td>
<td>Microsoft</td>
</tr>
<tr>
<td>GM</td>
<td>CONTINENTAL</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
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<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
<td>TOYOTA</td>
</tr>
<tr>
<td>BMW</td>
<td>BMW</td>
<td>BMW</td>
<td>BMW</td>
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<td>BMW</td>
<td>BMW</td>
<td>BMW</td>
<td>BMW</td>
</tr>
</tbody>
</table>

**Billing/ Payment**
- e.g. Daimler with PayCash
- e.g. Daimler with Moovel

**Services, content and apps**

**BATTLE FOR ADDITIONAL REVENUE STREAMS AND CUSTOMER INTERFACE**

**System integration**

**Hardware**

**Infrastructure**

Source: Oliver Wyman analysis

© Oliver Wyman
2a Trends: Recent developments
Diesel demand development (1/2)

Diesel sales have significantly declined in face of the recent diesel scandal and do not yet show a sign of recovery

Diesel share of passenger vehicles
In % of ICE vehicles, Jan 2015 – Sep 2018 by month

Commentary

- Sales of diesel driven vehicles have significantly declined across Europe and the US since the ‘Diesel-gate’
- Continued negative press and bad public perception on diesel emissions while in reality diesel total emission balance (for mid-sized & larger) is better than for gasoline
- Public uncertainty about future usefulness of diesel engines in face of public discussion on diesel bans in cities currently limits sales

"We definitely see massive decreases in the diesel share which puts a lot of pressure on the OEMs for hybrids and BEVs to meet CO2 targets"
– Senior Manager, Tier-1 Supplier

"For small PV we do not see any diesel engines anymore in the future. In the long-term we see approx. 20% market share of diesel in Europe"
– Senior Manager, Tier-1 Supplier

Source: KBA, SMMT, ANFIA, ANFAC, Wikipedia, Financial Times, Bloomberg, Tagesspiegel, n-tv, expert interviews, Oliver Wyman analysis
Diesel demand development (2/2)

Diesel sales have decreased across all segments in Germany since the diesel scandal, also in the more energy efficient segments.

### Diesel share of passenger vehicles by segment

In % of ICE vehicles, 2015 vs 2018

<table>
<thead>
<tr>
<th>Segment</th>
<th>2015</th>
<th>2018 to date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minis</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Small</td>
<td>5%</td>
<td>13%</td>
</tr>
<tr>
<td>Compact</td>
<td>44%</td>
<td>25%</td>
</tr>
<tr>
<td>Middle class</td>
<td>76%</td>
<td>53%</td>
</tr>
<tr>
<td>Upper middle class</td>
<td>90%</td>
<td>69%</td>
</tr>
<tr>
<td>Luxury class</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>Compact SUVs</td>
<td>50%</td>
<td>22%</td>
</tr>
<tr>
<td>Full-Size SUVs</td>
<td>80%</td>
<td>58%</td>
</tr>
</tbody>
</table>

**Commentary**

- Already in 2015, Diesel has been the primary energy source in the larger vehicle segments.
- Diesel shares have fallen significantly across all segments since 2015 in face of the diesel scandal.
- Decline of diesel share in mini and small car segments beneficial to overall emissions while decline in mid-sized to large segments will increase total emissions and thus pressure on OEMs to find alternative to meet fleet emission targets by 2021.

1. Segmentation according to KBA statistics
Source: Expert interviews, KBA, Tagesspiegel
Diesel market background

Diesel engine demand in Europe is supported by low tax, diesel attractiveness would significantly decline if lawmakers remove the benefit.

Fuel taxes for gasoline and diesel by country
In EUR/liter

<table>
<thead>
<tr>
<th>Country</th>
<th>Gasoline</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>0.42</td>
<td>0.72</td>
</tr>
<tr>
<td>Great Britain</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>Greece</td>
<td>0.41</td>
<td>0.67</td>
</tr>
<tr>
<td>Germany</td>
<td>0.47</td>
<td>0.66</td>
</tr>
<tr>
<td>France</td>
<td>0.43</td>
<td>0.61</td>
</tr>
<tr>
<td>Italy</td>
<td>0.42</td>
<td>0.56</td>
</tr>
<tr>
<td>Austria</td>
<td>0.40</td>
<td>0.48</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>0.32</td>
<td>0.46</td>
</tr>
<tr>
<td>Spain</td>
<td>0.33</td>
<td>0.43</td>
</tr>
<tr>
<td>Rumania</td>
<td>0.30</td>
<td>0.36</td>
</tr>
<tr>
<td>US1</td>
<td>0.10</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Commentary

- **Europe**: Gasoline fuel taxes generally higher than for diesel
  - Diesel favored by customers from TCO perspectives
  - Aim of governments to reduce CO₂ emissions and fuel consumption
  - Strong standing of European automotive industry developing diesel technology
- **US**: No tax incentive for diesel, diesel purchases in the US driven by utility considerations
  - No tax incentive and higher purchase prices
  - Use-case mainly for higher torque requirements/towing capabilities

1. Conversion rate: 1 USD = 0.81 EUR, 1 gallon = 3.79 l
Source: EIA, Statista, expert interviews, Oliver Wyman analysis
China light vehicle production | OEM shift
Western OEMs are losing ground in China in favor of local OEMs inducing a business risk for international players

## Chinese light vehicle production 2018 and 2023 by forecast year
In mn. light vehicles

<table>
<thead>
<tr>
<th>Chinese OEMs</th>
<th>Western OEMs</th>
<th>Eastern OEMs</th>
<th>Total Production</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2018</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>12.7</td>
<td>10.0</td>
<td>4.4</td>
</tr>
<tr>
<td>FC 2018 Q2</td>
<td>+7.6%</td>
<td>+0.1%</td>
<td>-2.9%</td>
</tr>
<tr>
<td><strong>2019</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>13.7</td>
<td>10.0</td>
<td>4.4</td>
</tr>
<tr>
<td>FC 2018 Q2</td>
<td>+10.2%</td>
<td>-0.1%</td>
<td>-2.9%</td>
</tr>
<tr>
<td><strong>2020</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>15.1</td>
<td>12.7</td>
<td>5.7</td>
</tr>
<tr>
<td>FC 2018 Q2</td>
<td>+10.2%</td>
<td>-7.8%</td>
<td>-17.2%</td>
</tr>
<tr>
<td><strong>2021</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>16.7</td>
<td>11.7</td>
<td>5.7</td>
</tr>
<tr>
<td>FC 2018 Q2</td>
<td>+10.2%</td>
<td>-7.8%</td>
<td>-17.2%</td>
</tr>
<tr>
<td><strong>2022</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>17.8</td>
<td>11.7</td>
<td>5.7</td>
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<tr>
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<td>+10.2%</td>
<td>-7.8%</td>
<td>-17.2%</td>
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<tr>
<td><strong>2023</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC 2016 Q2</td>
<td>19.0</td>
<td>11.7</td>
<td>5.7</td>
</tr>
<tr>
<td>FC 2018 Q2</td>
<td>+10.2%</td>
<td>-7.8%</td>
<td>-17.2%</td>
</tr>
</tbody>
</table>

### First insights

- Compared to the forecast 2016 Q2, overall car production 2018 in China is estimated to be higher
- Western and Eastern OEMs did not participate at higher volumes, while Chinese OEMs strongly increased production
- The trend of a shift to local OEMs is expected to accelerate until 2023
- A shift to local OEMs induces a major risk for Western automotive suppliers, which spent substantial amounts of CAPEX in China, as expected production volumes with key clients may not realize
- Participating at increased volume of local OEMs might be challenging due to a general preference of local suppliers

Source: LMC Automotive, Oliver Wyman Analyses
3 VALUE:
Automotive value creation development until 2030
Total automotive value creation development until 2030

Despite multi-dimensional changes, automotive value creation is expected to only track car production growth at around 2% p.a.

**Growth forecast of automotive market**

**Vehicle production volume**
- (in MM units)
  - 2017: 95
  - 2030: 123
  - Increase: 2.0%

**Value**
- (in € BN, inflation corrected)
  - 2017: 897
  - 2030: 1,169
  - Increase: 2.1%

**Production**
- 2030: 1,169
- Increase: 2.1%

**R&D**
- 2030: 897
- Increase: 2.1%

**Comment**

- The increase in *value creation* will mainly be driven by *vehicle production*, i.e. increasing *number of cars sold* and *higher value technologies* build into cars (~2.3% p.a.)

- **R&D gains only slightly** (0.4% p.a.) as already today industry players are investing heavily in the development of new technologies (e.g. vehicle electrification and autonomous driving), which is expected to remain stable or even decrease in future.

- Besides setting the right technological development focal areas, **OEMs and suppliers need to continuously increase efficiency** and subsequently decrease costs within their R&D efforts.

Source: Oliver Wyman value creation model
Regional shifts in automotive value creation until 2030
Emerging markets continue to catch-up and gain around 10 p.p. value creation share by 2030

Development of value creation by region/segment
In € BN

- **North America**: +1% → -2.9 p.p. from 196 to 222
- **Europe**: +1% → -3.1 p.p. from 266 to 310
- **China**: +4% → +6.5 p.p. from 178 to 308
- **Korea and Japan**: 0% → -4.3 p.p. from 161 to 160
- **South America**: +4% → +0.6 p.p. from 20 to 33
- **RoW**: +3% → +0.3 p.p. from 19 to 28
- **India**: +6% → +2.3 p.p. from 28 to 64
- **Rest of Asia (w/o India, China, Korea, Japan)**: +3% → +0.6 p.p. from 29 to 45

Source: Oliver Wyman value creation model
Horizontal shifts in automotive value creation until 2030

Value creation continues to grow along most steps of the value chain and modules with strong shift from value creation in ICE to electric drive systems

**Development of value creation**
In % of total

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Σ</td>
<td>€897 BN</td>
<td>€1,169 BN</td>
</tr>
<tr>
<td><strong>R&amp;D</strong></td>
<td><img src="chart1" alt="R&amp;D 2017" /></td>
<td><img src="chart2" alt="R&amp;D 2030" /></td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td><img src="chart1" alt="Production 2017" /></td>
<td><img src="chart2" alt="Production 2030" /></td>
</tr>
<tr>
<td><strong>Assembly</strong></td>
<td><img src="chart1" alt="Assembly 2017" /></td>
<td><img src="chart2" alt="Assembly 2030" /></td>
</tr>
</tbody>
</table>

**Comment**

- **E-drive gains** significantly share (+14%)
- In contrast traditional **ICE powertrain and auxiliary systems loose** share continuously
- Comparaably **high growth of E/E** eased by today’s high level of R&D efforts to rapidly foster trend technologies
- **Body-in-white, chassis and interior** expected to **grow below market**; But also in these categories **growth pockets exist**

Source: Oliver Wyman value creation model
Vertical shifts in automotive value creation until 2030
Outsourcing from OEMs to suppliers will continue but slow down; in E-Drive, OEMs will gradually build up own competence and rely for ADAS on suppliers

<table>
<thead>
<tr>
<th></th>
<th>2012 (vs. 2002)</th>
<th>2017</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEMs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suppliers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drivetrain</td>
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1. Driven by advancement of ADAS and autonomous driving (AD)
Source: Oliver Wyman value creation model
IMPACT:
Areas of impact and strategic business model options for automotive suppliers
Impact on suppliers: Many fronts
Development of new business/operating models and holistic performance improvement will be required for suppliers to remain competitive.