Global Sales and Production Redefined

19 October 2016 | Tokyo

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MARKET FLEXIBILITY
Volume
Where should you expand your production footprint?

RANGE FLEXIBILITY
Product
Which products will be strategic to future growth?

INDUSTRIAL FLEXIBILITY
Manufacturing
Industrial trends shaping the automotive industry
Global production

Post recovery cycle growth rates slow

- Greater China: 8.2 million
- South Asia: 4.5 million
- Europe: 2.6 million
- Middle East/Africa: 1.2 million
- North America: 1.1 million
- South America: 0.8 million
- Japan/Korea: -0.8 million

CAGR 8.3% (2007-2023)

Source: IHS Markit

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China

Growth moderates as pressures build; focus on technology

- Economic pressures slow growth rates to ‘new normal’ levels
- Government intervention to support no less than 6.5% GDP
- Latest 5-Year Plan will boost infrastructure, NEVs and sharing economy
- Second child and regional planning to balance long term outlook
- Urbanization to accommodate cleaning of manufacturing and lower carbon development

Source: IHS Markit

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Brazil, Russia, India and ASEAN

Reset the map; Brazil and Russia lose momentum

- Brazil and Russia face prolonged recessions; signs of hitting the floor only just emerging
- Failure to diversify into exports during expansion years limits ability to offset domestic weakness
- India realising potential after political impasse; infrastructure investments to pay off
- ASEAN has slowed but exports have helped and AEC could provide stimulus and bolster existing regional hubs

Source: IHS Markit

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North America

Mexico pushes region to new highs but plateau coming soon

- Strong recovery cycle in US sees post-crisis restructuring pay off, greater capacity discipline, platform alignment and renewed focus on exports
- GM, FCA unwind Canada footprint volume moves south
- Mexico set for another phase of investment from D3, Asians and Europeans
- Localization overseas and domestic ceiling will cap growth in this cycle
Europe

Flexibility key and Central Europe becomes attractive again

- Big 5 western European producers supported by strengthened domestic recovery but Brexit poses risks
- Exports to North America remain robust but China capacity investments will that flow
- Increased movement across the region reflects enhanced flexibility and willingness to change
- Central Europe gains: Daimler Hungary, FCA, GM, Poland, JLR Slovakia, VW Slovakia, Poland

Source: IHS Markit

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Brexit the global risk

Cumulative adjusted demand 2016 to 2023

- UK -1.2 Mn
- Europe -1.0 Mn
- North America -550k
- China -680k
- MEA -420k
- South America -280k
- South Asia -280k
- JPN/KOR -150k
## Brexit impact on UK production – initial analysis

<table>
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<tr>
<th>Brexit event</th>
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Automotive Conference – Tokyo | October 2016

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Brexit exposure UK operations

GM-Ellesmere Port
110,000 units
Current cycle Dec 2021

JLR-Halewood
180,000 units
Current cycle Mar 2022

Bentley-Crewe
13,000 units
Current cycle Jun 2023

BMW-Oxford
206,000 units
Current cycle Jun 2022

Honda-Swindon
144,000 units
Current cycle Jun 2022

Nissan-Sunderland
520,000 units
Current cycle Jun 2021

Toyota-Derby
167,000 units
Current cycle Mar 2019

JLR-Castle Bromwich;
Solihull 405,000 units
Current cycle Mar 2023

GM-Luton 76,000 units
Current cycle Mar 2026

BMW-Goodwood
4,400 units
Current cycle Dec 2021
Japan/Korea

Domestic output constrained; overseas expansion dominates

- Following short term stimulus/disruption in both markets as the result of consumption tax cuts long term return to trend of decline and stagnation.

- Japanese OEMs pick up overseas growth hedge to currency movements despite recent support for exports.

- Hyundai/Kia pursues expansion; NA and India mix mature and emerging.

Source: IHS Markit

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OEM growth distribution
2015 to 2023

- **Renault/Nissan**: +2.4Mn, +3.2% p.a. *
- **Volkswagen**: +1.8Mn, +2.1% p.a.
- **Hyundai**: +1.4Mn, +2% p.a.
- **Toyota**: +1.2Mn, +1.4% p.a.
- **Honda**: +1.0Mn, +2.6% p.a.
- **General Motors**: +0.9Mn, +1.3% p.a.
- **Suzuki**: +0.6Mn, +2.6% p.a.
- **PSA**: +0.6Mn, +2.1% p.a.
- **BMW**: +0.4Mn, +2% p.a.
- **FCA**: +0.4Mn, +1% p.a.
- **Ford**: +0.4Mn, +0.7% p.a.

* p.a. = per annum
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The future mobility jigsaw is starting to fall into place

New business models will materialize

Mobility will be redefined

Technology and society drive fundamental change

VMT = Vehicle miles travelled
Future mobility patterns emerging (1/2)

• Rapid increase in expectation of disruption of traditional business models as new personal mobility options emerge and evolve

  ➢ KPMG Survey* - 82% of execs now say a major business model disruption is ‘extremely likely’ or ‘somewhat likely’ – it was just 12% last year

  ➢ only 33% think that current OEMs will retain customer relationship – it was 75% last year

  ➢ IBM survey** suggests by 2025 personal mobility developments could become more important than economic and market trends

  ➢ 66% of consumers say they expect new types of ownership models to be offered

* Source: KPMG Global Automotive Executive Survey 2016

** Source: IBM Automotive 2025: Industry Without Borders 2015
Future mobility patterns emerging (2/2)

• Developed market car cultures have embedded inertia to fast and fundamental change, Emerging market consumers are far more open to new modes
  
  ➢ Preference of traditional ownership to a car as a service model: US/Europe ~ 40-50%, Rest of World ~30%, China/India ~20% (KPMG Survey)
  
  ➢ IBM survey – EM’s showed 20-25% higher declared interest in ‘mobility solutions’ than Mature markets
  
  ➢ Stated ‘interest’ in self driving cars lowest in mature markets, highest in emerging markets (Japan and Brazil are exceptions to both)

• Premium’s chances? Potential impact on premium is equally questioned as it is for low cost manufacturers
  
  ➢ “The important image attached to a car seems to lose significant importance in a future dominated by sophisticated mobility services” (KPMG survey ‘editorial’)

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New mobility megatrends converge to a potential ‘Giga-Trend’

- **New customers**
  - Car-Share
  - Ride-Share

- **Disruptors**
  - Traditional Ownership model (CaaP)
  - Sharing Economy (CaaS)

- **New Form of mobility**
  - Autonomous
  - Automated
  - L5 (CaaS)

- **Greatest disruptor to Automotive Industry**
  - Driver is Person
  - Electrification (CaaSGridUnit)
New manufacturing required...

Greater product customisation?
Greater regional diversity?
Brand values re-imagined?
Increasing need to build closer to consumers?
Current scale models too rigid?
Product cadence likely to accelerate further?
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Age of the Mega Platform

Reduced purchasing costs and accelerated development times

Increased flexibility and product cadence compared to traditional floorpan and top hat

Suppliers will need to support volume and geographic requirements

OEMs purchasing strategies have been driving consolidation in the supplier sector

Global platforms will support 69% of new light vehicle production by 2023
Age of the Mega Platform

New architectures drive greater efficiency short term

Source: IHS Markit

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Does the Volkswagen scandal reveal the next challenges in vehicle production?

“...Mercedes Is About to Unveil an Entire Fleet of Electric Vehicles”
Bloomberg August 2016

“...Electric powertrains will "reinvent the car" says Jaguar design chief”
Autocar April 2016

“...BMW revamps "i" electric car division to focus on self-driving tech”
Reuters June 2016

“...Ford making long-range EV to rival GM, Tesla”
Detroit News April 2016
New vehicle concepts challenge manufacturing efficiency – importance of flexibility
New vehicle usage concepts challenge manufacturing efficiency – importance of flexibility

Personal mobility, short commutes, delivery vehicles
High EV penetration

Longer distance, family mobility, outside of city or urban areas, hybridisation still likely to dominate
## The view from Asia

**Definition**: ⊙=most dependent, ○=dependent, △= less dependent, × = optional or no development

<table>
<thead>
<tr>
<th>OEM</th>
<th>Target Year</th>
<th>HEV</th>
<th>PHEV</th>
<th>FCV</th>
<th>EV</th>
<th>Electrification Strategy</th>
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<tbody>
<tr>
<td>Toyota</td>
<td>2050</td>
<td>⊙</td>
<td>○</td>
<td>△</td>
<td>×</td>
<td>PHEV is a mainstay, based on the deeply-evolved and widely-spread HEV technology, followed by FCV.</td>
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<tr>
<td>Nissan</td>
<td>2050</td>
<td>△</td>
<td>×</td>
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<td>⊙</td>
<td>Battery EV and range-extender EV are mainstays, followed by the e-Bio Fuel-cell vehicle.</td>
</tr>
<tr>
<td>Honda</td>
<td>2050</td>
<td>×</td>
<td>⊙</td>
<td>○</td>
<td>△</td>
<td>PHEV is a mainstay, evolved by the i-MMD hybrid system, followed by FCV (without HEV).</td>
</tr>
<tr>
<td>Hyundai</td>
<td>2020</td>
<td>⊙</td>
<td>○</td>
<td>×</td>
<td>△</td>
<td>HEV is a mainstay, but the dedicated models will offer other electrified models such as PHEV and EV.</td>
</tr>
</tbody>
</table>
Can modular architectures support greater electrification?

‘Mainstream’ offerings likely to develop concept of complimentary platform structures

- It is expected that MQB and MEB will operate hand in hand.
- This “complimentary” platform structure ensures flexibility and planning reliability in either case: BEV boom vs. BEV flop
- Allows OEM to switch or re-balance the production mix of BEV models and more conventional products

“MEB ensures to produce pure electric vehicles, hybrid cars and conventional powertrains, cost efficiently on a single production line!”

Frank Welsch
Head VW brand R&D, Volkswagen AG
Can modular architectures support greater electrification?

**Modular Toolkit – Brand Responsibilities**

- **MQB**: Modular Standard Drivetrain Toolkit
- **MLB**: Modular Longitudinal Toolkit
- **MQB**: Modular Transverse Toolkit
- **MNB**: Modular Commercial Vehicles Toolkit
- **MMB**: Modular mid-engine-Toolkit
- **MSB**: Modular Standard Drivetrain Toolkit

**Vehicle Price**

- **A0**: Needs to be cost efficient!
- **A**, **B**, **C**, **D**, **E**: Focused on image and technology, not cost

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Summary

• Extraneous shocks and gathering pace of change forcing genuine re-evaluation of outlook: what will it mean to be in the automotive sector in early 2020s?

• New ownership, operation and usage patterns expected to be a major determining force alongside already identified move to greater fuel efficiency and reduced greenhouse gases

• Customer facing business models changing with balance of power shifting to less ‘core-automotive’ experiences

• Changes will have a tangible effect on manufacturing as OEMs respond to new requirements; greater importance of flexibility over efficiency during transitional steps

• OEM responses will vary challenging existing consensus