



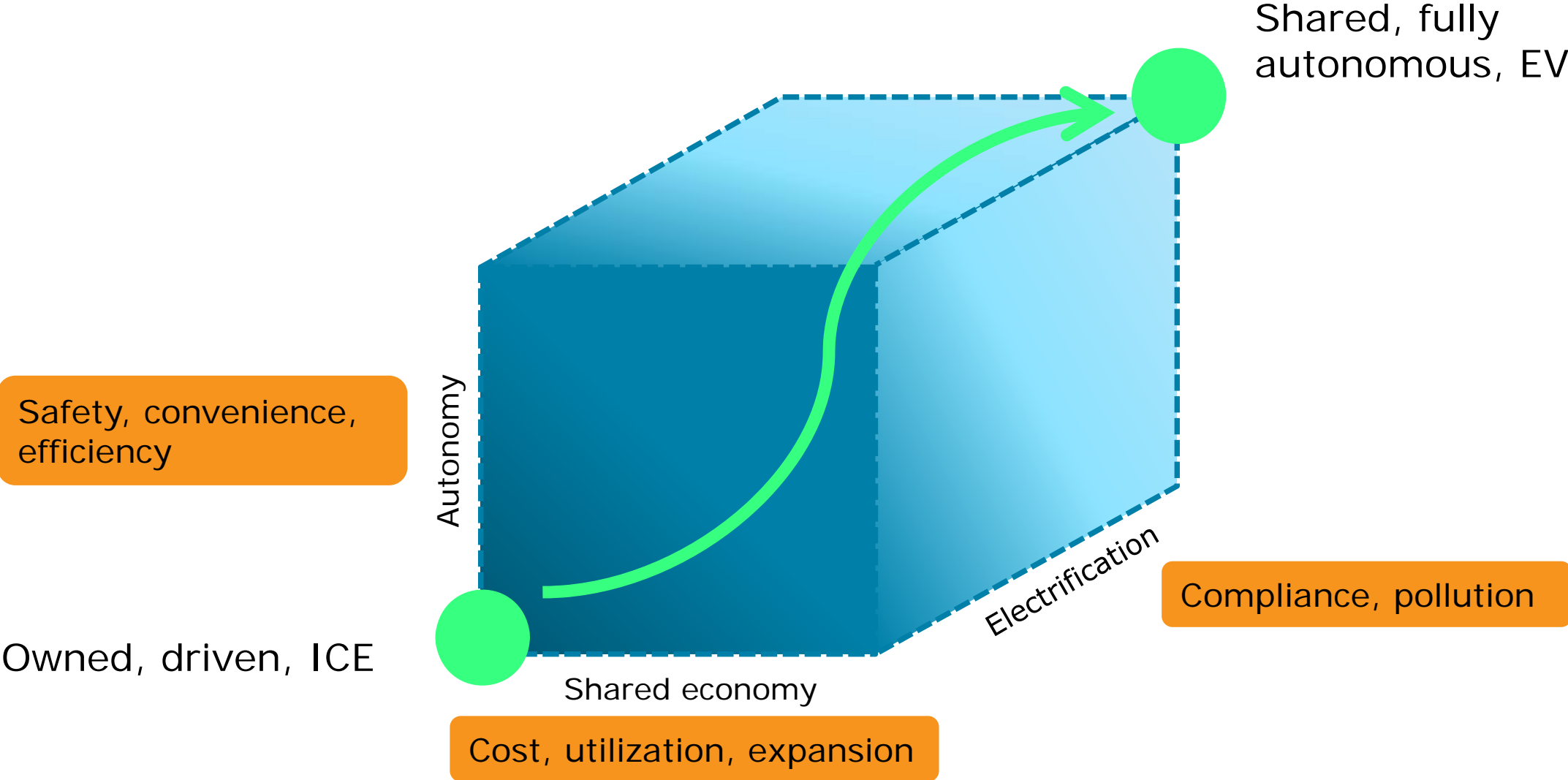
AUTOMOTIVE

Future of Autonomy and Mobility

27 September 2016 | Frankfurt

Alastair Hayfield, Senior Manager,
+44 (0) 1933 40 22 55,
alastair.hayfield@ihsmarkit.com

Three megatrends



Some recent questions from the industry...

“Can you forecast the development of L3, L4, and L5?” - **OEM**

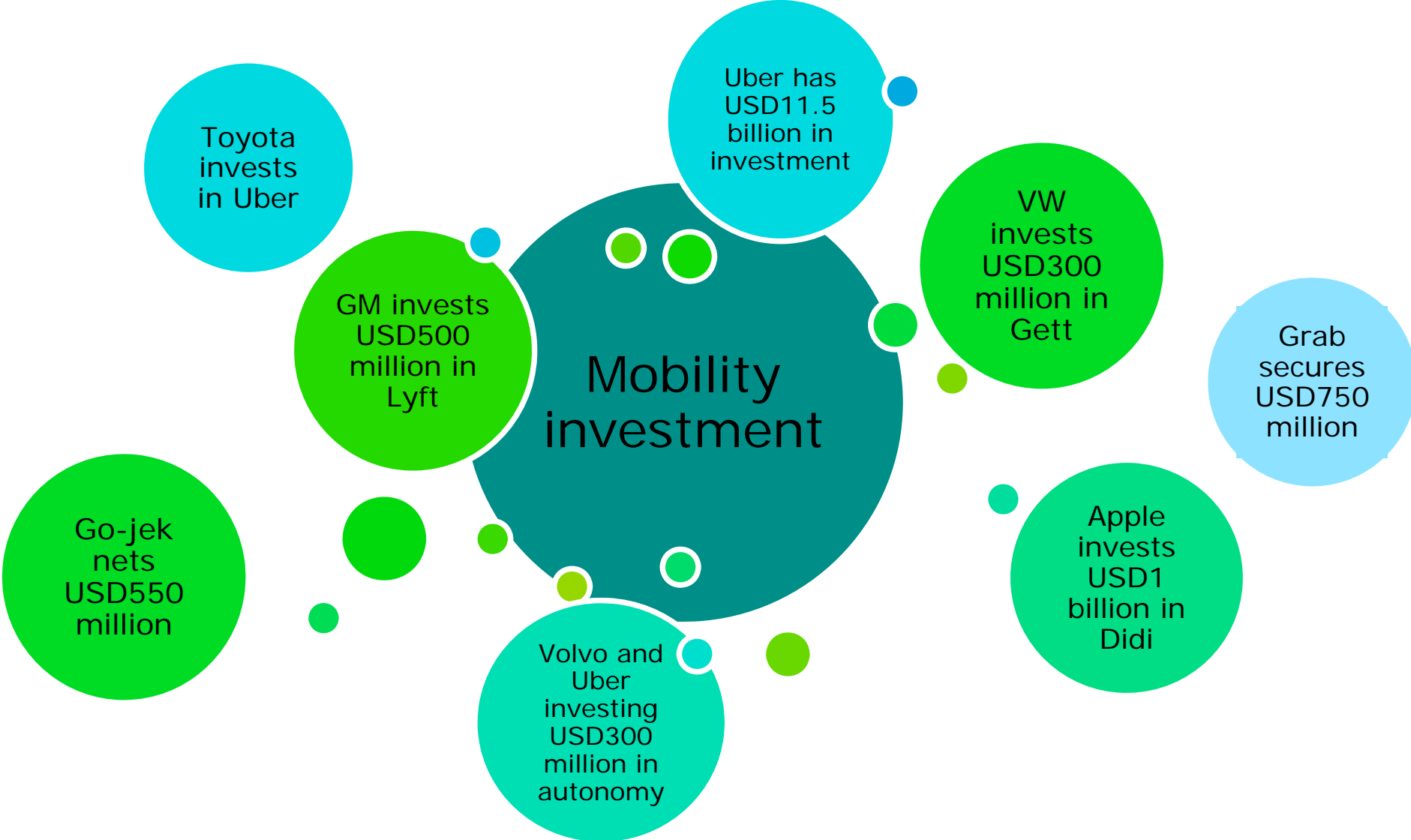
“What will be the impact of shared mobility on our long term business?” – **Materials supplier**

“How do you see city/interstate infrastructure and building design changing as a result of autonomy?” – **Tier 1**

“Can you measure the user experience of mobility services?” - **OEM**

“How will autonomous vehicles impact the products we make in the future?” – **Transmissions supplier**

Mobility investment



Market factors

Regulation

Regulatory activity is already influential, but it becomes one of the most important market forces for ADAS

NCAP

US NCAP adding 7+ new ADAS in 2018

Euro NCAP continues to move forward on new AEB features

Little-to-no activity from other countries

Voluntary agreements

US commitment for standard AEB by 2022

Will effectively make AEB standard everywhere in a few years, with rare local model exceptions

What is next?

Standards and guidance

ISO 26262 + ASIL

New automated vehicle guidelines expected in US

Steady progress on cybersecurity and driver distraction guidance in US

Sharing economy

Open question everywhere today

Even China allowed ride-hailing services in legal grey zone

Regulation likely to be defined by the current market

Guidance will shape the future of automotive technology, regulatory decisions will affect how the sharing economy evolves

Automakers

OEMs racing to deploy new tech via myriad strategies, as gap between luxury and mass market narrows and startups challenge perennial luxury leaders

Luxury leaders

Volvo XC90/S90
BMW 7 Series
Tesla Model S

2017 Mercedes-Benz
E-Class
2017 Audi A8

Tesla

Autopilot 2.0 coming
Standard hardware?
Trifocal camera
1 x front radar
4 x corner radar
+ OTA update

Taking algorithms
further in-house

Mass market

Still mostly packages
of ADAS options but
moving forward

Nissan Piloted Drive
roadmap to 2020

Startups

Atieva
Faraday Future

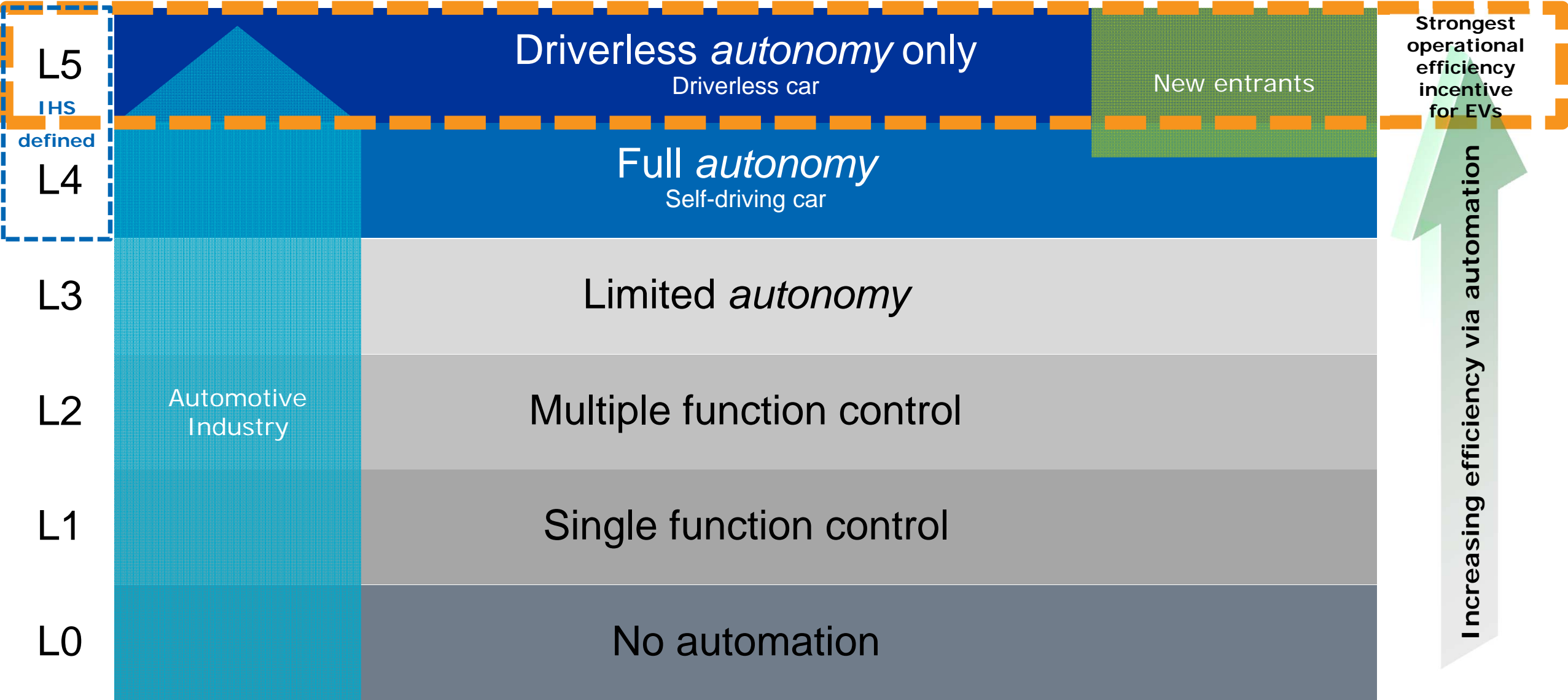
NextEV

LeEco

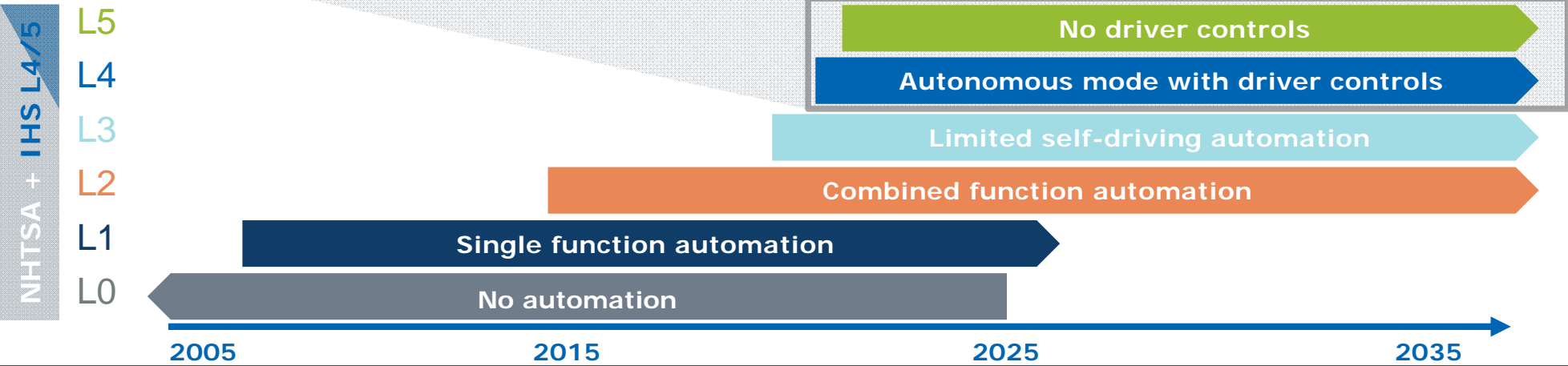
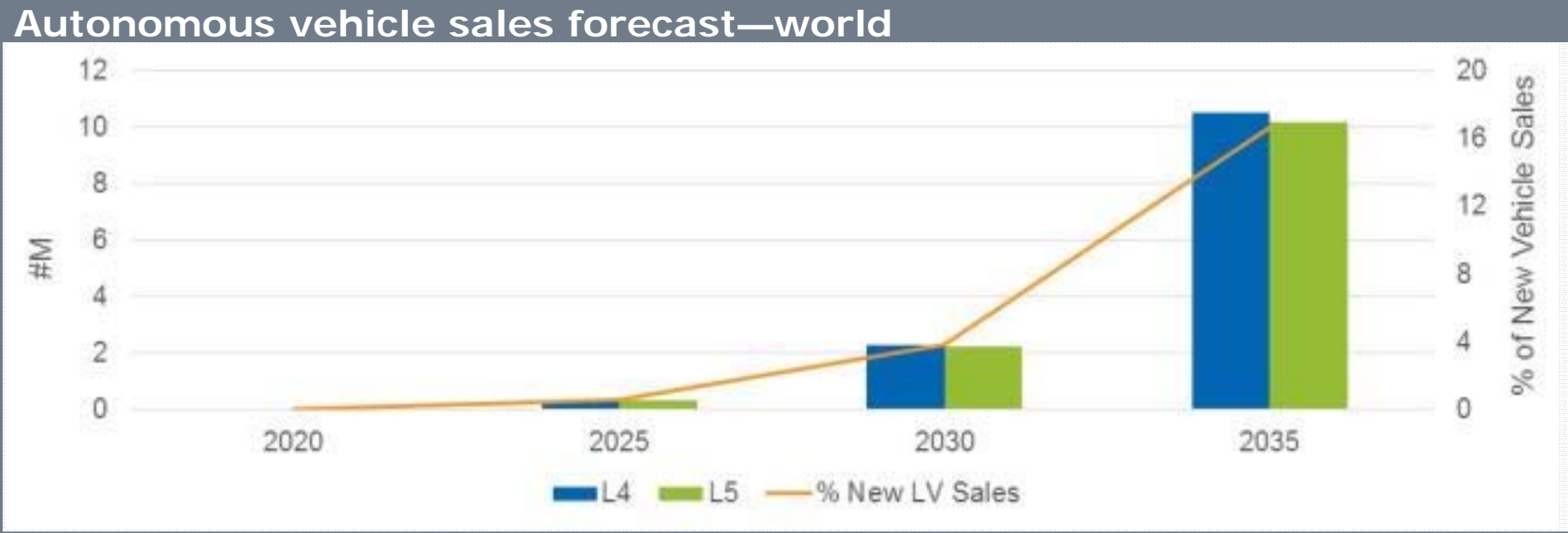
Karma

Deployment of automated driving tech is one of the most strategic decisions an OEM faces, with regulation and evolving mobility also major factors

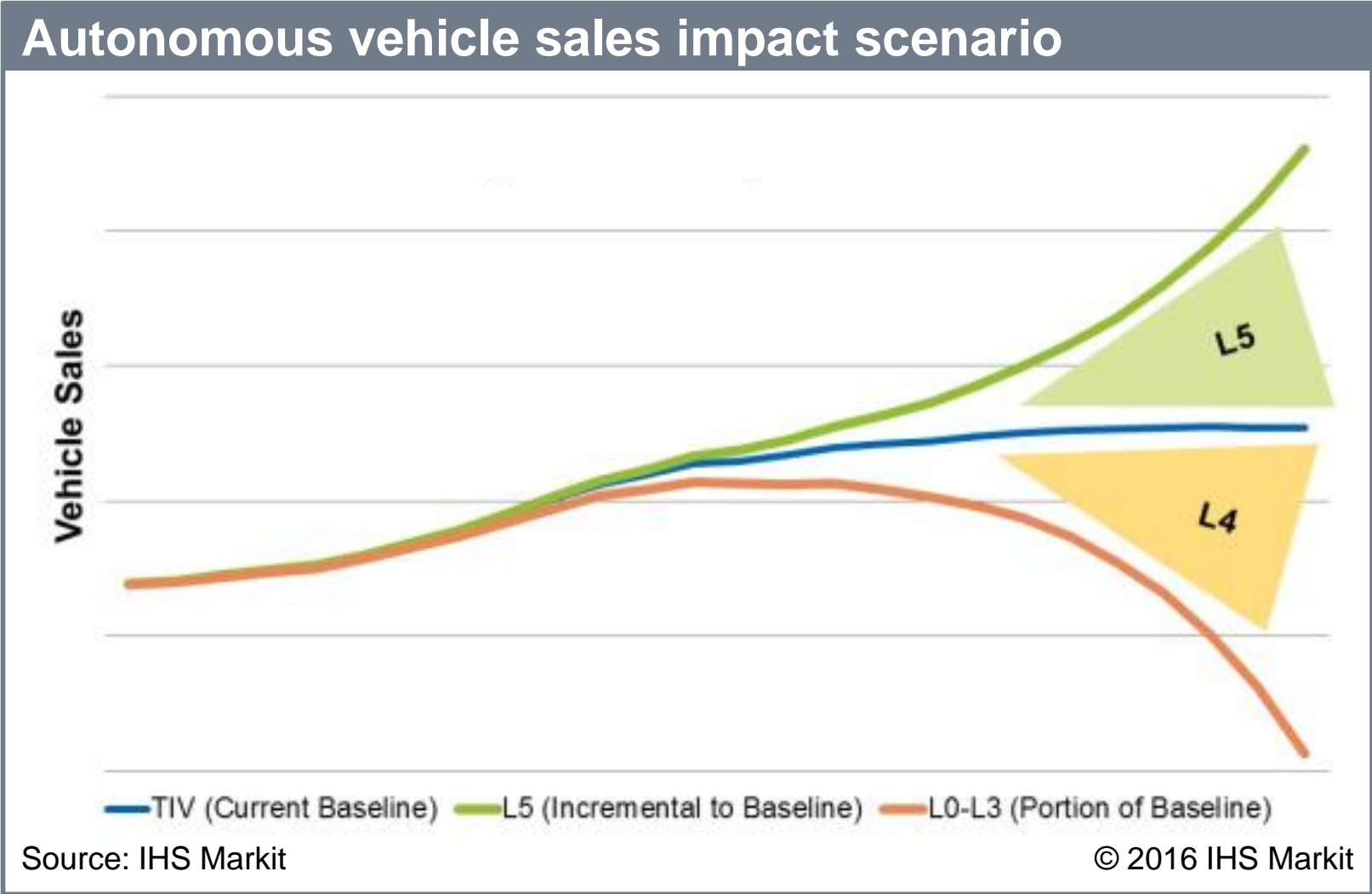
Automation evolving



Autonomous vehicle forecast—June 2016



Autonomy scenario: Industry impact visualized



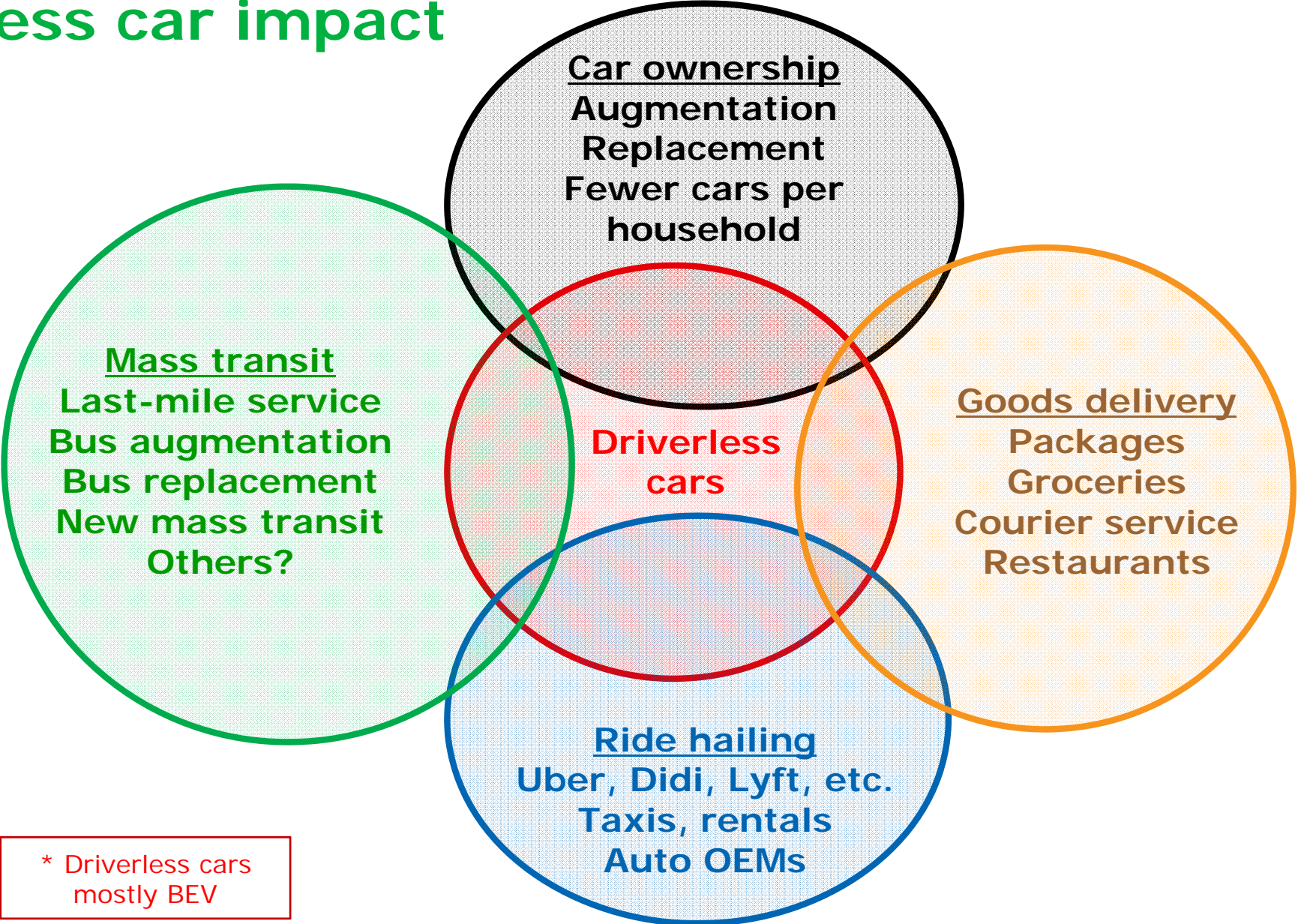
As autonomous vehicles arrive, the market impact is split between:

1. Replacing or updating **current** forecast volumes
2. Adding incremental volume **beyond current** forecast

Autonomous vehicles can broadly correlate to mobility service models:

- L4 – **Car sharing**
- L5 – **Ride hailing**

Driverless car impact



Mobility

Mobility

New mobility services are evolving quickly and challenging traditional tech development, market deployment, and consumer exposure

Uber

Determined and acting quickly
Acquire and deploy plus shed losses
Uber and Volvo
Uber and Toyota
Uber and Otto

Ride-hailing

Didi wins in China
Daimler merging MyTaxi and Hailo
VW and Gett
GM and Lyft
Delphi in Singapore

Car sharing

Smaller fleets but consistent users and often profitable
Rental car companies adding new tier of service
OEMs starting their own services

Automakers

Ford _____
BMW iNext
Uber XC90
Chevrolet Bolt

OEMs and suppliers are investing heavily to understand the market, seize opportunities, and capture early market share that can be adapted later

Car-sharing brands

Maven (GM)



ReachNow (BMW)



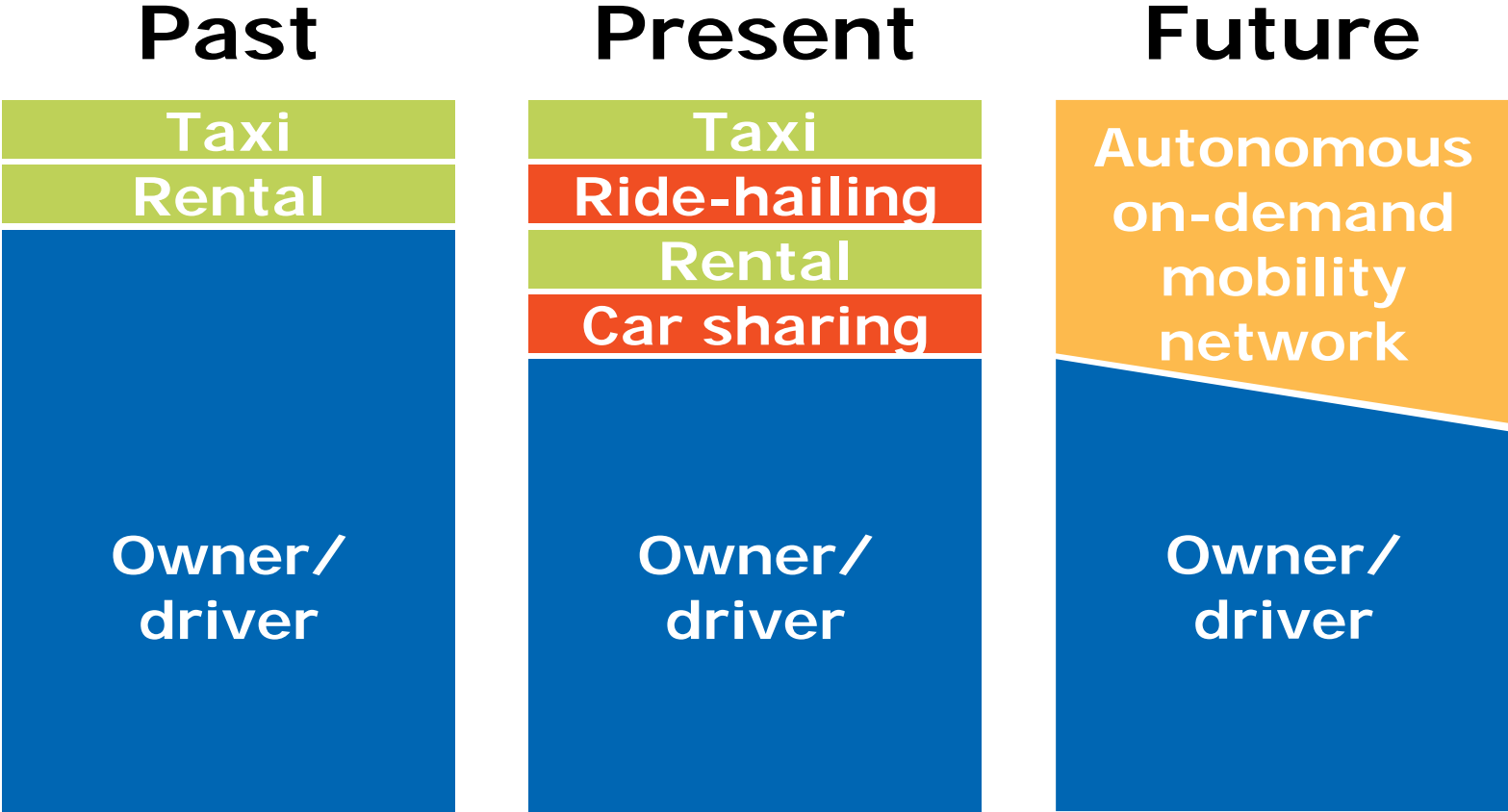
car2go (Daimler)



Mobility changing what it means to be a brand

- OEMs have sharing brands (GM-Maven, Daimler-car2go, BMW-DriveNow/ReachNow)
- Distinct operations, service-based business models
- Act as a test bed for new business model, sales channel, and new vehicles
- Aim to be a lifestyle brand that connects home, work, devices, personal transport
- In 20 years, is the service/experience of a mobility solution what defines the brand, not the vehicle?
 - Availability, cost/flexibility, ease-of-use, integration with “digital life”

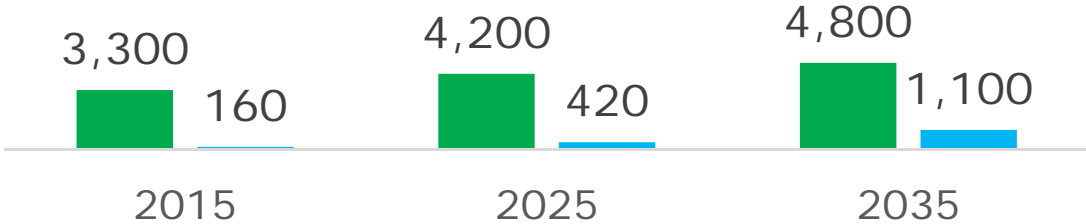
Car-based urban mobility is reshaping transportation



Where we are going: Scenario

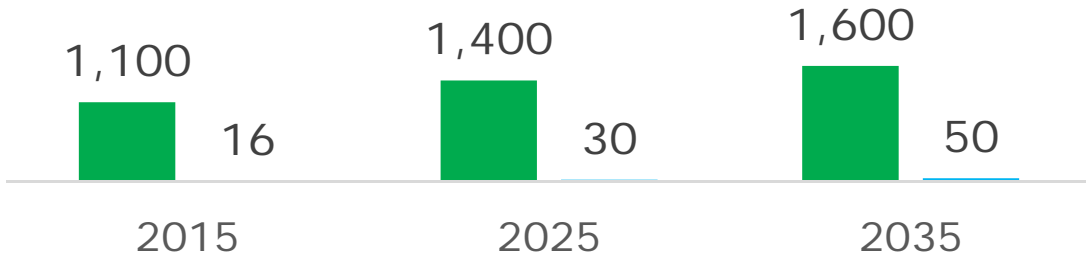
Total daily trips (millions)

Owned Shared



Vehicle parc (millions)

Owned Shared



Owned parc	1.1B	1.4B	1.6B
Average trips/day	3	3±	3±
Total trips/day	3.3B	4.2B	4.8B

Shared parc	16M	30M	50M
Average trips/day	10	14+	22+
Total trips/day	160M	420M	1,100M

**Driverless car mobility scales extremely well compared with current cars
Smaller fleets operate efficiently and make mobility available to more people**

Mergers and acquisitions

Supply chain and ecosystem consolidation plus mobility services are fueling partnerships and M&A activity—new players are coming

Didi and Uber China

Most significant consolidation in mobility to date
Good for Didi/Uber
Negative for drivers and users because of reduced competition and fewer subsidies

Suppliers

Uber/Otto
ZF/TRW/Ibeo
Delphi/Ottomatika
Freescale/Cognivue
Lear/Arada

Automakers

Ford colead investor in Velodyne
Tesla/Solar City
GM/Cruise
GM interest in Lyft?
German OEMs investing in mobility

Tech companies

Baidu colead investor in Velodyne
Intel/Itseez
Intel/Nervana
Samsung interest in Magneti Marelli?

Changes in the supply chain and in consumer-facing markets will continue to force the industry to rethink and reposition within a changing landscape

A note about Apple...

Why is Apple looking at the auto industry?

	Key information	Other information
Law of large numbers	<ul style="list-style-type: none"> ▶ 2015 revenue: USD234 billion; +28% ▶ First-quarter 2016 revenue: USD76 billion; +2% 	<ul style="list-style-type: none"> ▶ 10% growth is USD23 billion* ▶ Net income of USD18.4 billion
Slowing growth	<ul style="list-style-type: none"> ▶ iPhone growth slowing ▶ Limited current product growth 	<ul style="list-style-type: none"> ▶ 68% of revenue in December quarter ▶ Apple Watch has potential
Need new markets	<ul style="list-style-type: none"> ▶ Few high-tech opportunities ▶ Apple needs big opportunities 	<ul style="list-style-type: none"> ▶ For Apple leadership ▶ To grow—even 10% per year
Auto industry	<ul style="list-style-type: none"> ▶ Auto sales: USD3,000 billion-plus ▶ Auto content value: USD20 billion-plus ▶ Transportation: USD5,000 billion-plus 	<ul style="list-style-type: none"> ▶ Growing slowly and erratically ▶ Growing very fast! ▶ New growth opportunities
Auto changes	<ul style="list-style-type: none"> ▶ Becoming software-centric ▶ Becoming connection-centric ▶ BEV lowers entry barriers ▶ New business models: CAAS 	<ul style="list-style-type: none"> ▶ Apple strength ▶ Apple strength ▶ Apple opportunity ▶ Disruptive opportunity

What is Apple good at?

	Key information
User interface	<ul style="list-style-type: none"> ▶ Apple has set the HMI standard many times <ul style="list-style-type: none"> ▶ Macintosh: PC graphical user interface (GUI) ▶ iPhone: Smartphone user interface
Software ecosystem	<ul style="list-style-type: none"> ▶ Macintosh: Open APIs for writing Macintosh apps ▶ iPhone: Open APIs and tools for writing iPhone apps
New business model	<ul style="list-style-type: none"> ▶ iPhone app store: Distribution channel and platform for software publishing with low share to Apple ▶ iPod: Vast music library for download fee that lowered music industry piracy
Apple brand building	<ul style="list-style-type: none"> ▶ High-end products with luxury brand image ▶ Positioned to build a loyal and repeat customer base
System design	<ul style="list-style-type: none"> ▶ Proprietary hardware using system on a chip (SOC) ▶ Proprietary software with open APIs for third-party apps
Supply chain management	<ul style="list-style-type: none"> ▶ Contract manufacturing for hardware and SOCs ▶ System software suppliers and 1 million-plus apps in app store

Apple Product Scenarios?

Scenarios	Key Information	Comments
BEV Strategy-2020	<ul style="list-style-type: none"> ▶ Luxury SDC connected and leveraging Apple's i-products ▶ Solves the SDC to HDC HMI ▶ Apple HW & SW designed 	<ul style="list-style-type: none"> ▶ Only low volume needed for significant revenue ▶ HMI is core Apple strength ▶ Contract manufacturing
BEV & SDC Strategy-2025	<ul style="list-style-type: none"> ▶ Luxury DLC connected and leveraging Apple's i-products ▶ To consume Apple content-apps ▶ Apple HW & SW designed 	<ul style="list-style-type: none"> ▶ Luxury CaaP for wealthy ▶ CaaS for luxury usage ▶ Aspirational growth ▶ Contract manufacturing
BEV & DLC Strategy-2025	<ul style="list-style-type: none"> ▶ Luxury DLC connected and leveraging Apple's i-products ▶ Apple HW & SW designed ▶ Revenue from CaaS operation 	<ul style="list-style-type: none"> ▶ CaaS for high-end and luxury usage ▶ Contract manufacturing ▶ 20% profit margin feasible
Far Out Strategy-2035	<ul style="list-style-type: none"> ▶ Local mfg. Partly 3D printing ▶ Apple HW & SW designed ▶ Supply chain management 	<ul style="list-style-type: none"> ▶ When is tech ready? ▶ New mfg. technologies ▶ Apple core strength

Summary

Vehicle technology evolves quickly, but complexity and deep learning change the way systems are designed.

Crowd-sourced map and OEM-owned driving data will further increase the value of connectivity and updatable hardware.

Technology deployment happens more quickly than ever. Planning becomes even more important.

Mobility services will change how automakers approach the market, plan products, and position their brand.

Strategic investments and acquisitions help secure valuable opportunities in a rapidly evolving transportation industry.

Thank you!

IHS Markit Customer Care:

CustomerCare@ihsmarkit.com

Americas: +1 800 IHS CARE (+1 800 447 2273)

Europe, Middle East, and Africa: +44 (0) 1344 328 300

Asia and the Pacific Rim: +604 291 3600

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