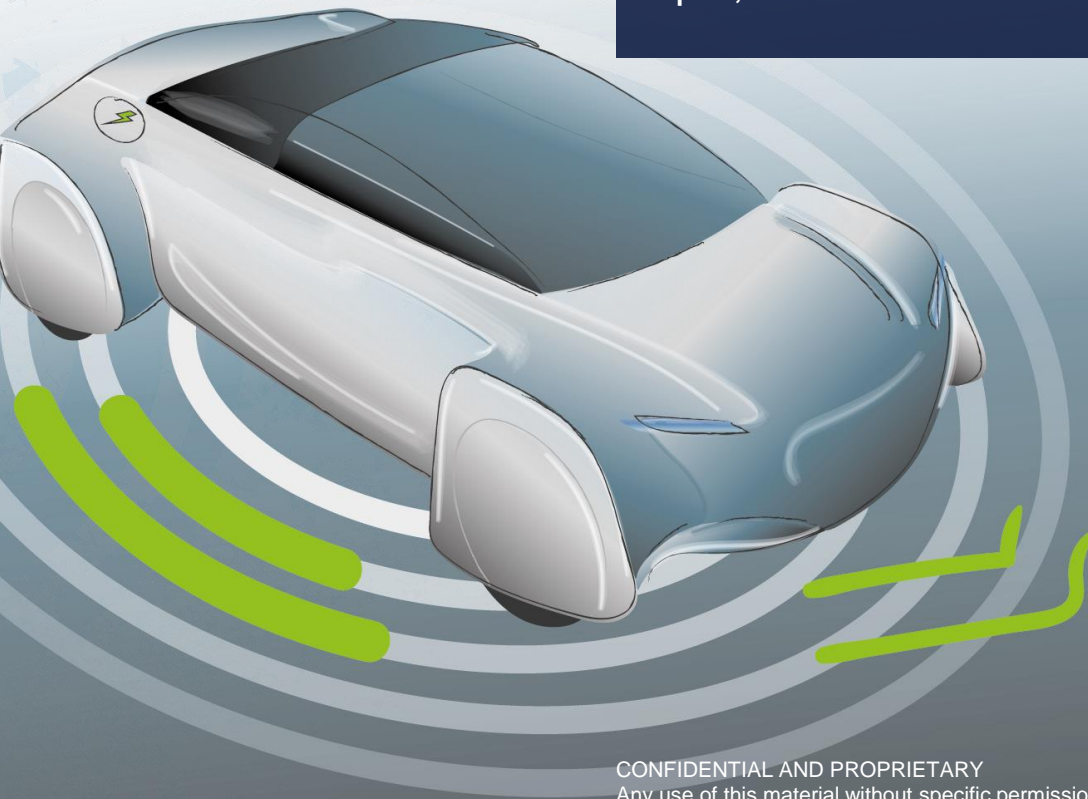McKinsey&Company

Automotive Revolution – perspective towards 2030

Stanford University, PEEC Sustainable Transportation Seminar
April, 1 2016

Global megatrends are having a far-reaching impact on many industries

Industrialization and **urbanization** in **emerging economies**

**Sustainability regulation** and **policies**

Changing **demographics** and **consumer preferences**

Rise of **new technologies** (digitization, IoT, Industry 4.0, …)

Global megatrends trigger trends in the automotive industry that have the potential to radically change the mobility industry

4 disruptive technology-driven trends

Electrification

Connectivity

Autonomous driving

Diverse mobility

8

Key statements

1
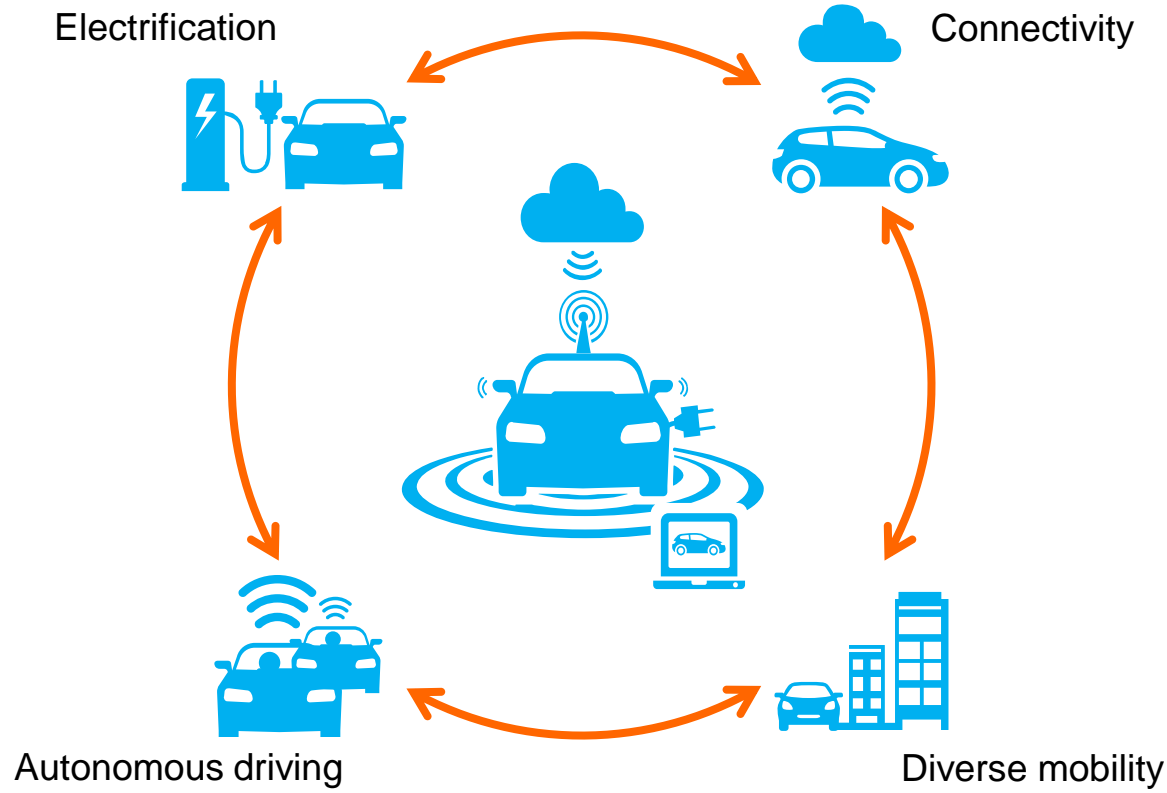
Driven by shared mobility, connectivity services, and feature upgrades, new business models could expand automotive revenue pools by ~ 30%, adding up to ~ USD 1.5 trillion
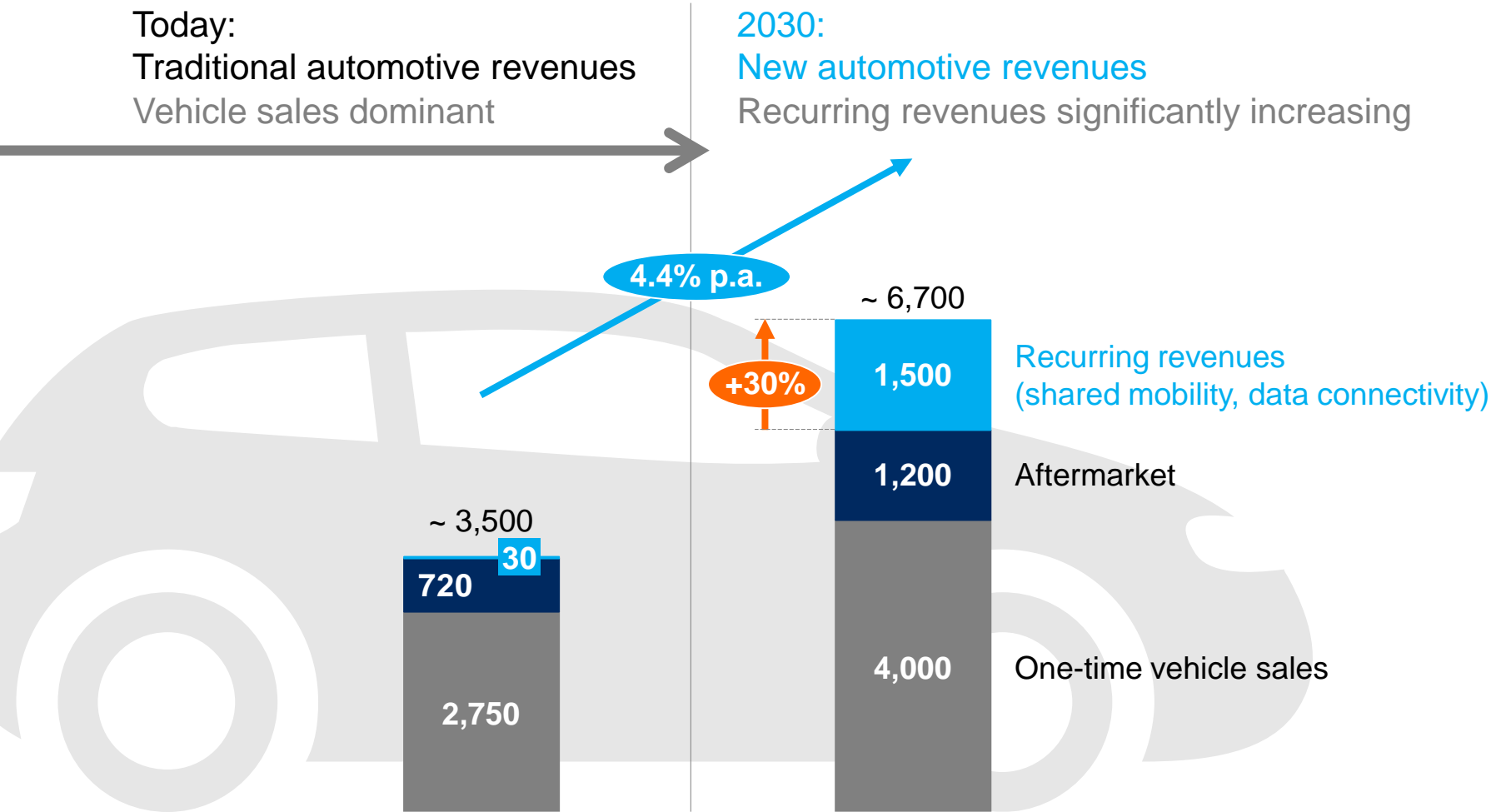
The automotive revenue pool will grow and diversify with new services, potentially becoming a ~ USD 1.5 trillion market in 2030

USD billions

Today:
Traditional automotive revenues
Vehicle sales dominant

2030:
New automotive revenues
Recurring revenues significantly increasing

4.4% p.a.

~ 6,700

+30%

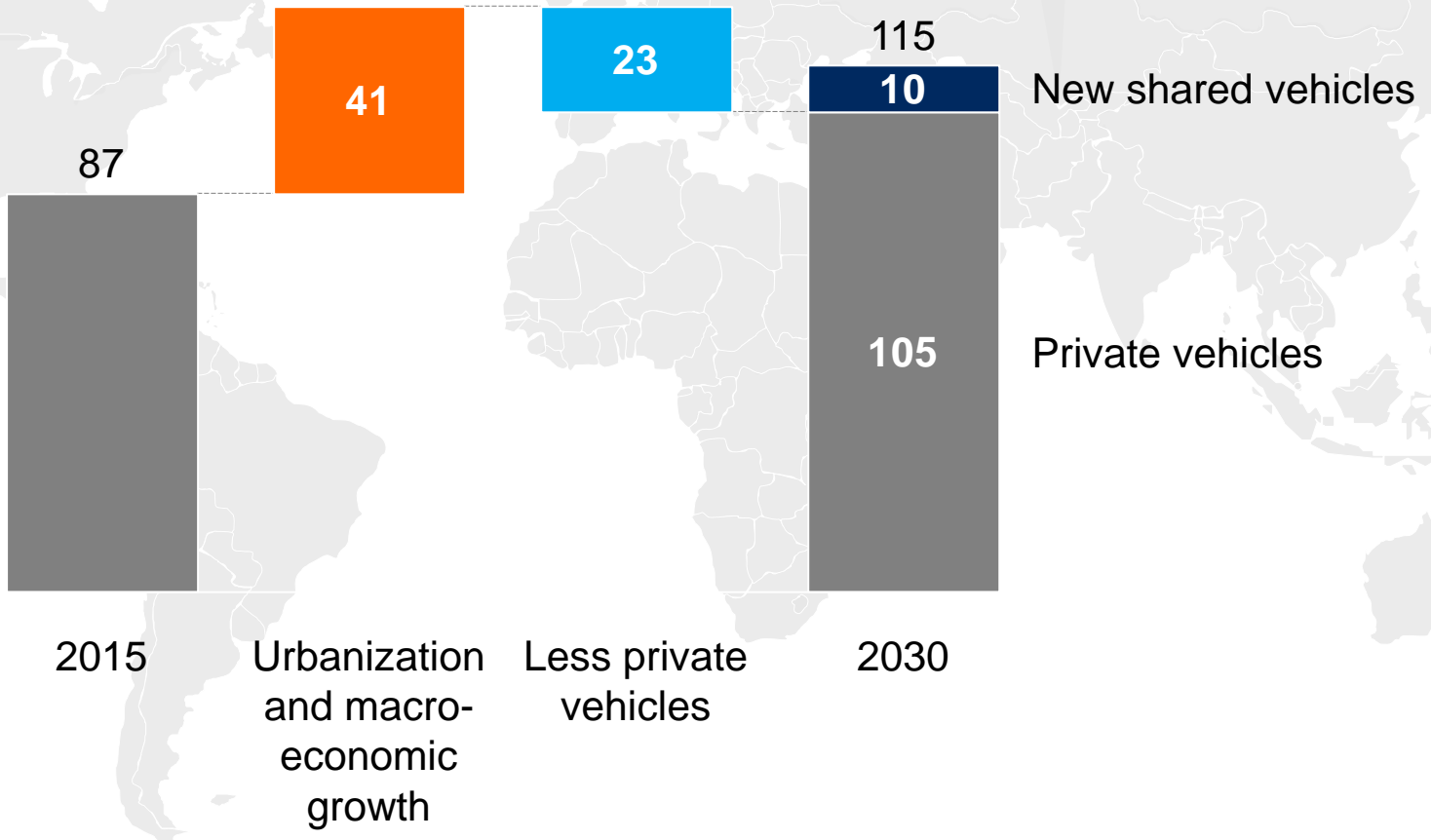|	
1,500	Recurring revenues (shared mobility, data connectivity)
1,200	Aftermarket
4,000	One-time vehicle sales

~ 3,500

30
720
2,750

2

Despite a shift towards shared mobility, vehicle unit sales will continue to grow, but likely at a lower rate of ~ 2% p.a.

Driven by urbanization and macroeconomics, global vehicle sales will continue to grow, although at a slower pace

Current and future annual global vehicle sales, millions

87 — 2015

41 — Urbanization and macro-economic growth

23 — Less private vehicles

115
10 — New shared vehicles
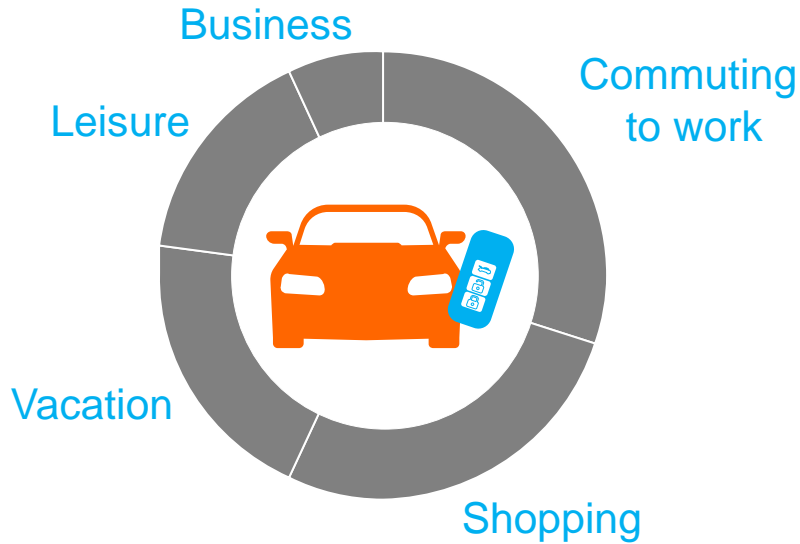105 — Private vehicles
2030

3

Consumer mobility behavior is changing, leading to up to 1 out of 10 cars sold in 2030 potentially being a shared vehicle and the subsequent rise of a market for fit-for-purpose mobility solutions

Today, consumers use their vehicles for every purpose; in the future, they will choose an optimal mobility solution for each different specific purpose
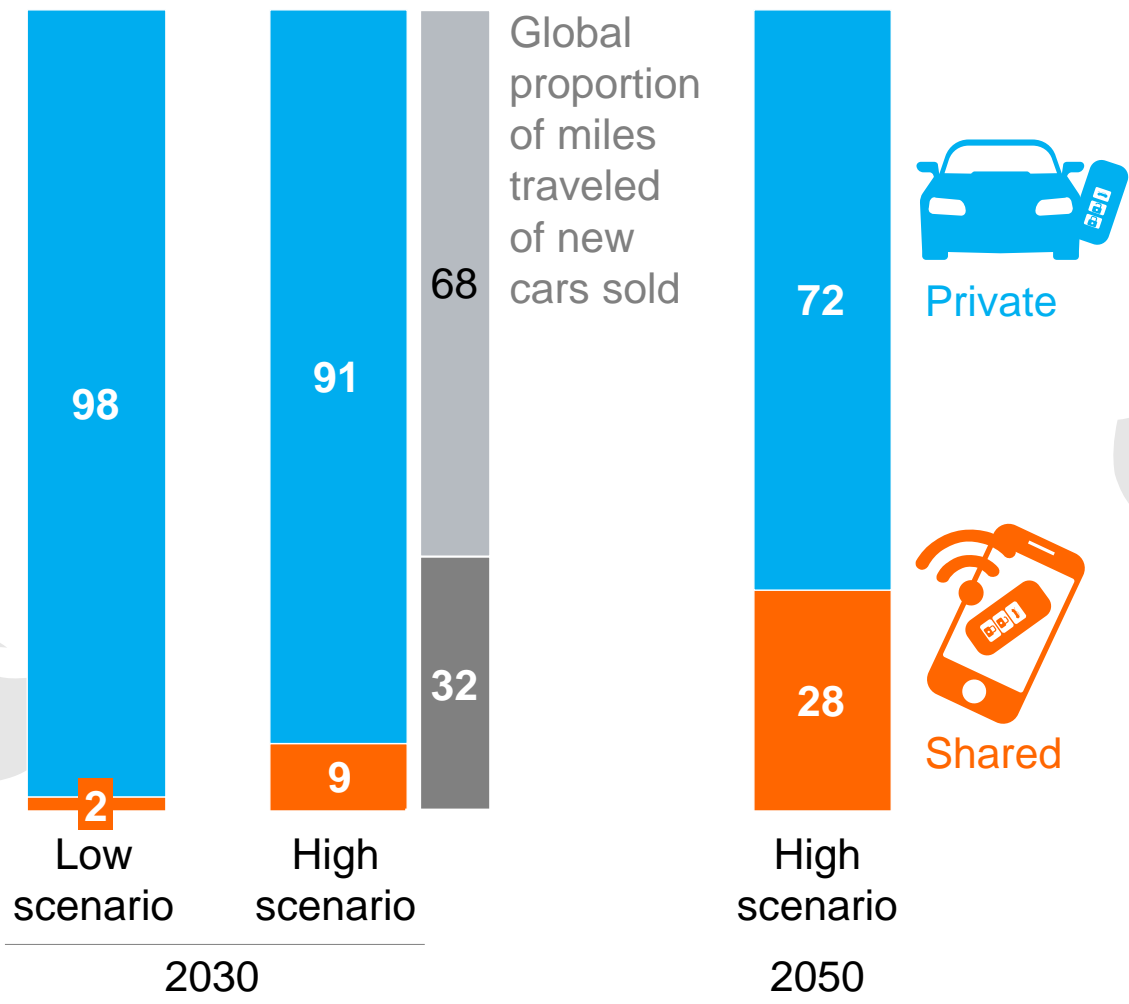
Today:
One vehicle for every trip purpose

2030:
A solution for each different specific purpose

Business

Commuting to work

Leisure

Vacation

Shopping

Business

Leisure

Commuting to work

Vacation

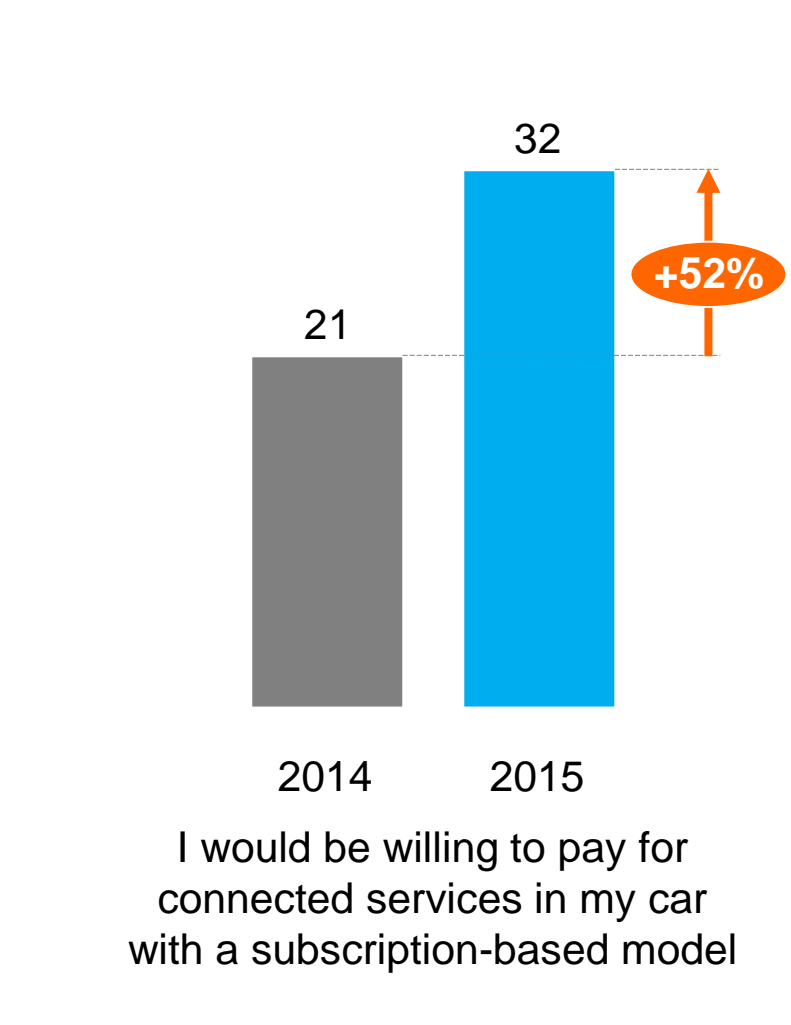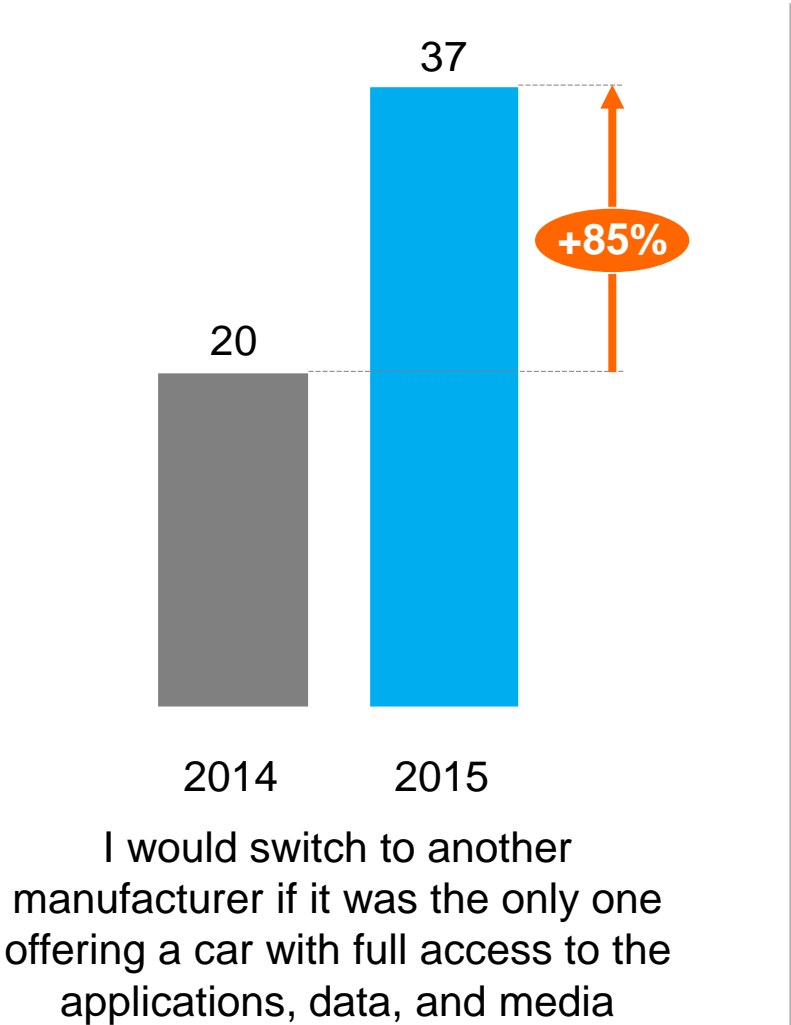Shopping

+ non-vehicle modes of mobility

Car sharing is a growth industry, accounting for up to 9% of new vehicles by 2030 at the expense of private use vehicle sales

Global proportion of shared vehicles, percent

Global proportion of miles traveled of new cars sold

Private

Shared

Low scenario | High scenario

2030

High scenario

2050

Both willingness to switch manufacturer and to pay a subscription fee for connected car services has increased significantly in the past year

Percent of respondents answering "yes"

37

20

+85%

2014   2015

I would switch to another manufacturer if it was the only one offering a car with full access to the applications, data, and media

32

21

+52%

2014   2015

I would be willing to pay for connected services in my car with a subscription-based model

OEMs are more trusted in Germany than in China in terms of data privacy and protection

Percent
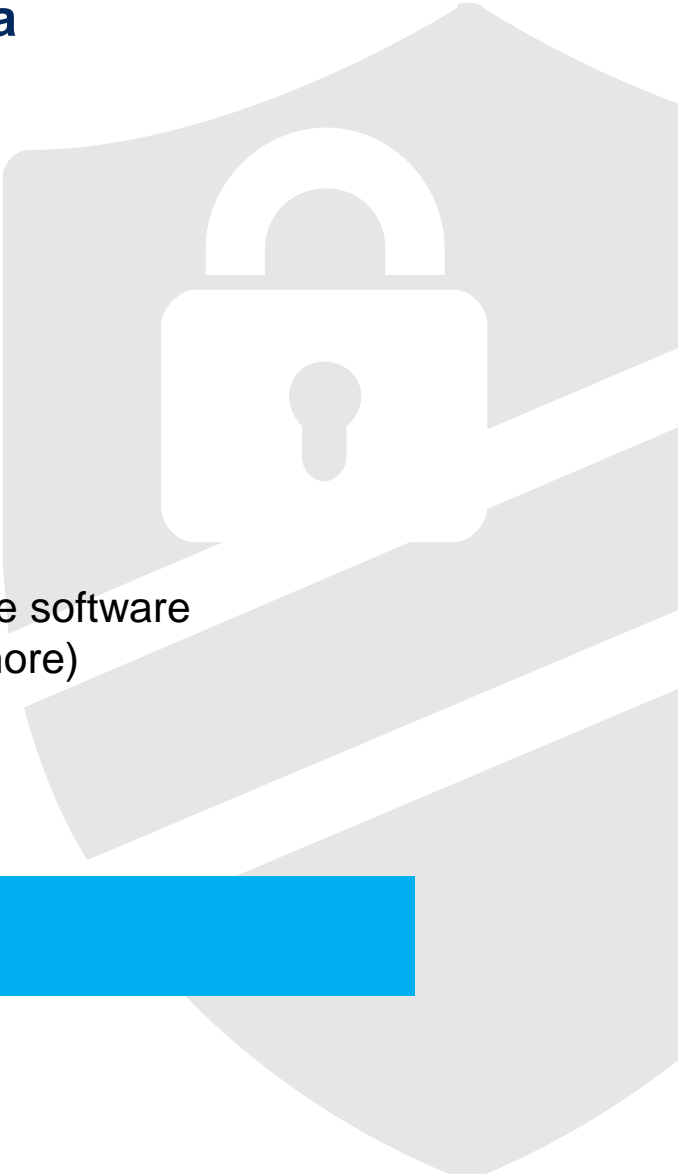
Trust in OEMs[1]

	Less likely (trust OEMs more)	More likely (trust smartphone software manufacturers more)
Germany	35	8
China	21	50
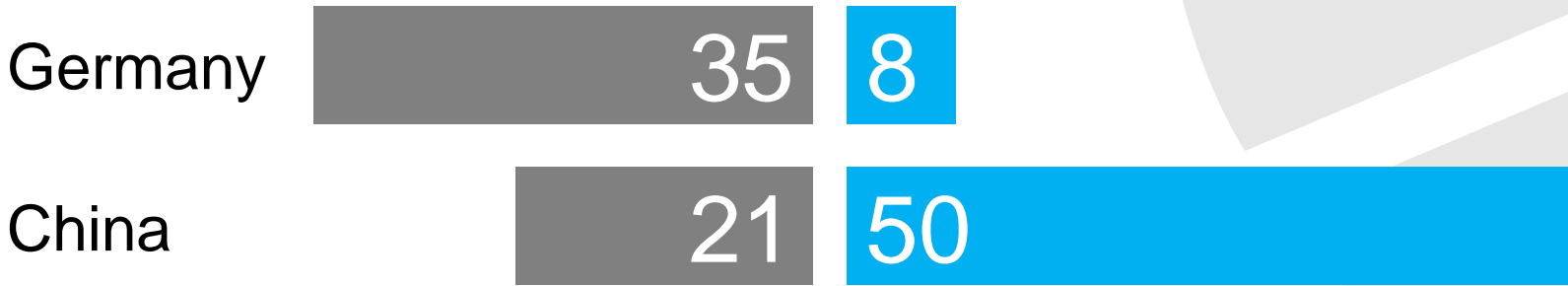
1 Total of 100% per country: answers from respondents who indicated either "no preference" or "neither of those listed" are not shown

4

City type will replace country or region as the most relevant segmentation dimension that determines mobility behavior and, thus, the speed and scope of the automotive revolution

A granular view of city types is necessary to understand the effects of urbanization and changes in mobility behavior

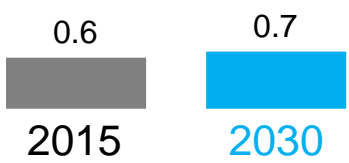Global population by archetype, billions

"High-income, dense cities"

Examples:
London, New York City, Singapore

0.3 (2015) 0.4 (2030)
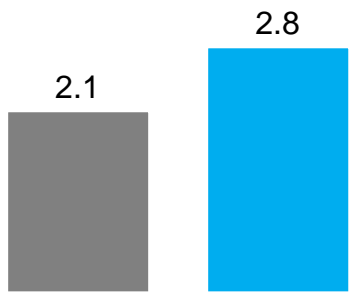
"Low-income, dense cities"

Examples:
Mumbai, Buenos Aires, Minsk, Mexico City

2.1 (2015) 2.8 (2030)

"High-income, suburban sprawl"

Examples:
Sydney, Los Angeles, Nagoya

0.6 (2015) 0.7 (2030)

"Low-income, suburban sprawl"

Examples:
Perm in Russia, Chongqing in China

1.1 (2015) 1.5 (2030)
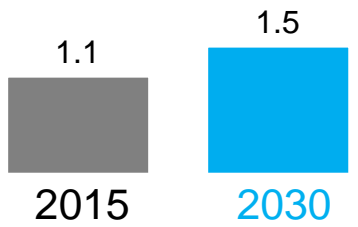
"Small towns and rural regions"

Examples:
Kansas in the US, Yunnan province in China, Provence in France, rural India

3.2 (2015) 3.2 (2030)

2015   2030
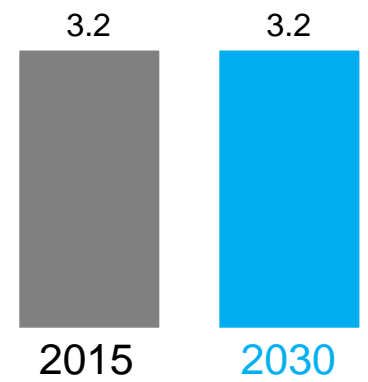
The effects of car sharing, urbanization, and macroeconomics on vehicle sales vary greatly by region and city type

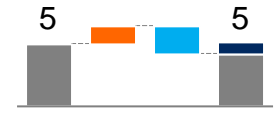## Current and future annual vehicle sales per city type, millions

Legend:
- ■ Urbanization and macroeconomic growth (orange)
- ■ Less private vehicles (light blue)
- ■ New shared vehicles (dark blue)
- ■ Private vehicles (gray)

	"High-income, dense cities"	"High-income, suburban sprawl"	"Low-income, dense cities"	"Low-income, suburban sprawl"	"Small towns and rural regions"
Europe and North America (2015 → 2030)	5 → 5	22 → 21	2 → 3	2 → 3	8 → 8
Asia and rest of the world (2015 → 2030)	7 → 13	3 → 5	13 → 22	7 → 9	17 → 26
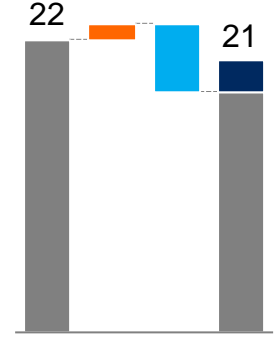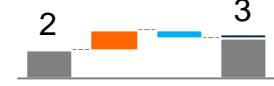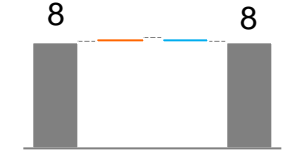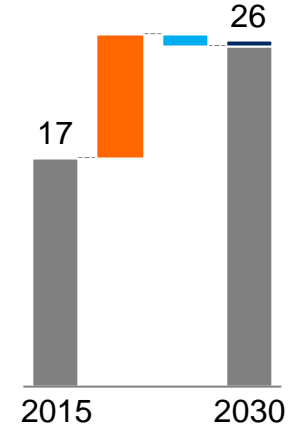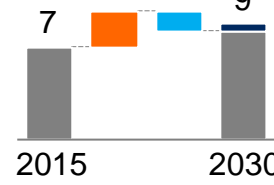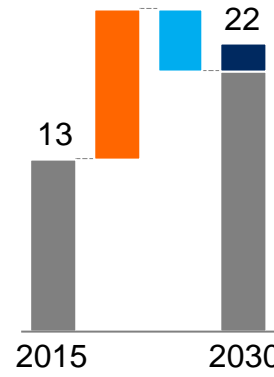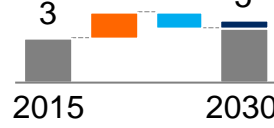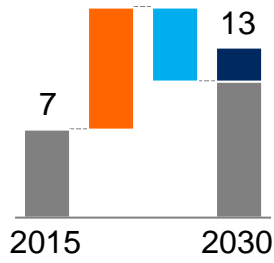
5

Once technological and regulatory issues have been resolved, up to 15% of new vehicles sold in 2030 could be fully autonomous
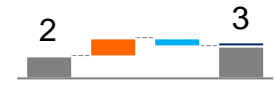
Technical, consumer acceptance and legal/regulatory barriers could hold back AV introduction

SIMPLIFIED

Challenge
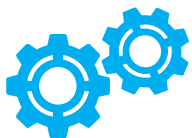
Explanation

Technology

- Technology hurdles for market deployment are non-trivial:
- Failsafe autonomous software design for immense number of situations
- Adequate degree of system redundancy
- Protection against cybersecurity threats

Consumer acceptance

- Risk of critical incidents affect consumer perception and slows adoption
- Reliability more critical than for other consumer products (e.g. smartphone)
- 'Hindenburg moment' could turn media support into hostility
- Unresolved degree of human trust to cede control to car

Law and regulation

- Certification and state-of-the-art for autonomous car to be established
- Liability distribution between OEM, driver, data provider … unclear
- Automotive regulation typically develops a very slow pace
- Ethical issues of automated decision making in an accident challenging

» The degree to which these barriers materialize can serve as signposts for the rate of adoption

Subject to progress on the technical, infrastructure, and regulatory challenges, up to 15% of all new vehicles sold in 2030 could be fully autonomous

New vehicle market share of fully autonomous vehicles
Percent

High-disruption scenario entails
- Regulatory challenges overcome in key markets
- Safe and reliable technical solutions fully developed
- Enthusiastic consumers who are willing to pay

Commercial introduction of full autonomy by new tech players and premium OEMs

Manufacturing capacity for tech players ramps up gradually

Mass-market leaders introduce full autonomy

Ramp-up as AV availability spreads across popular consumer models

Slow consumer uptake driven by low perceived value proposition or negative publicity follow-ing critical incidents

Technical and regulatory barriers delay commer-cial-scale introduction of autonomous vehicles

High scenario for conditional or better autonomy (L3+)

High scenario for full autonomy (L4)

Low scenario for conditional or better autonomy (L3+)

Low scenario for full autonomy (L4)

15%

6

Electrified vehicles are becoming viable and competitive; however, the speed of their adoption will vary greatly at the local level

The future of electrified vehicle adoption will be shaped by consumer pull and regulatory push factors, with electrified powertrains comprising up to 50% of new car sales in 2030
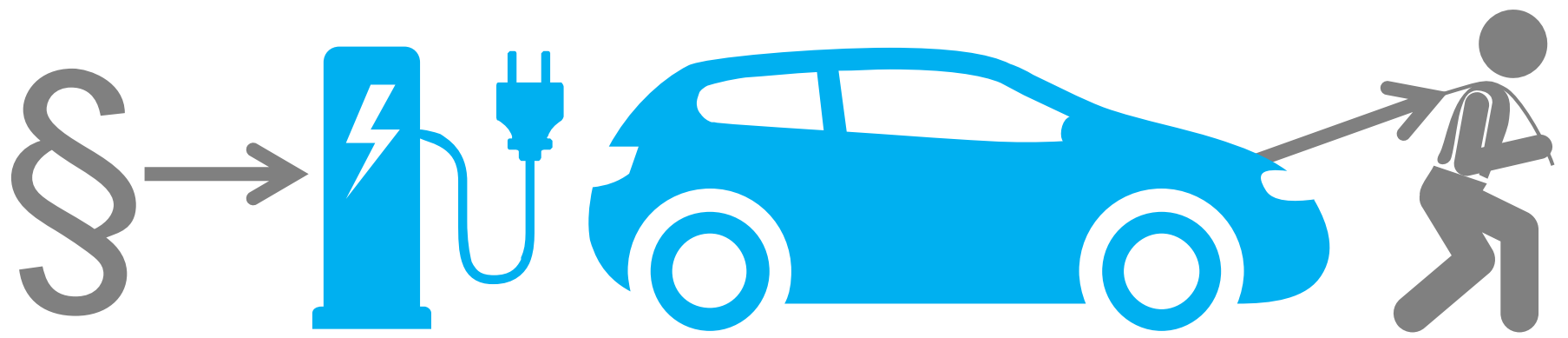
Regulatory push

Aggressive increase in emissions targets regulation leading up to 2030

Rising citizen concern for climate change

New and continued xEV subsidies

Consumer pull

High-performance EVs demonstrate growth potential of premium segment

Oil and battery prices change total cost of ownership for mass-market segments

High loyalty of current xEV owners

Within a more complex and diversified industry landscape, incumbent players will simultaneously compete on multiple fronts and cooperate with competitors

The increasing complexity of the competitive landscape for individual mobility will force OEMs to fight battles on multiple fronts

Past:
OEMs compete with one another
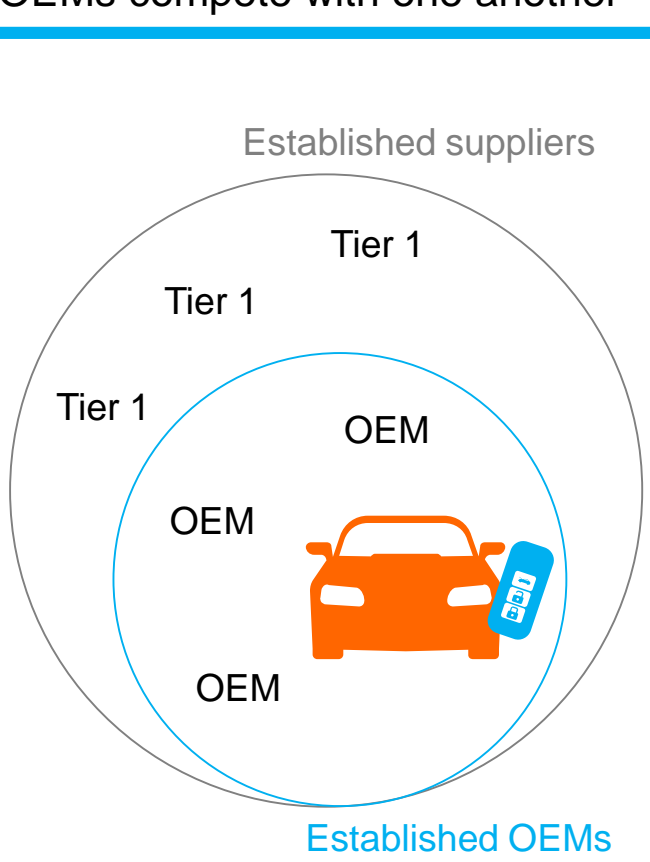
2030:
OEMs compete in a complex market landscape

Established suppliers

Tier 1
Tier 1
Tier 1
OEM
OEM
OEM

Established OEMs

Established suppliers

Tier 0.5
Tier 1
Tier 1
OEM OEM
OEM
Established OEMs

E-hailing
Didi Kuaidi

Mobility providers

Car sharing
Zipcar

?

Chinese OEM
BYD

Specialty OEM
Tesla

?

Consumer electronics
Apple

Software
Google

?

Emerging OEMs

Tech giants

8
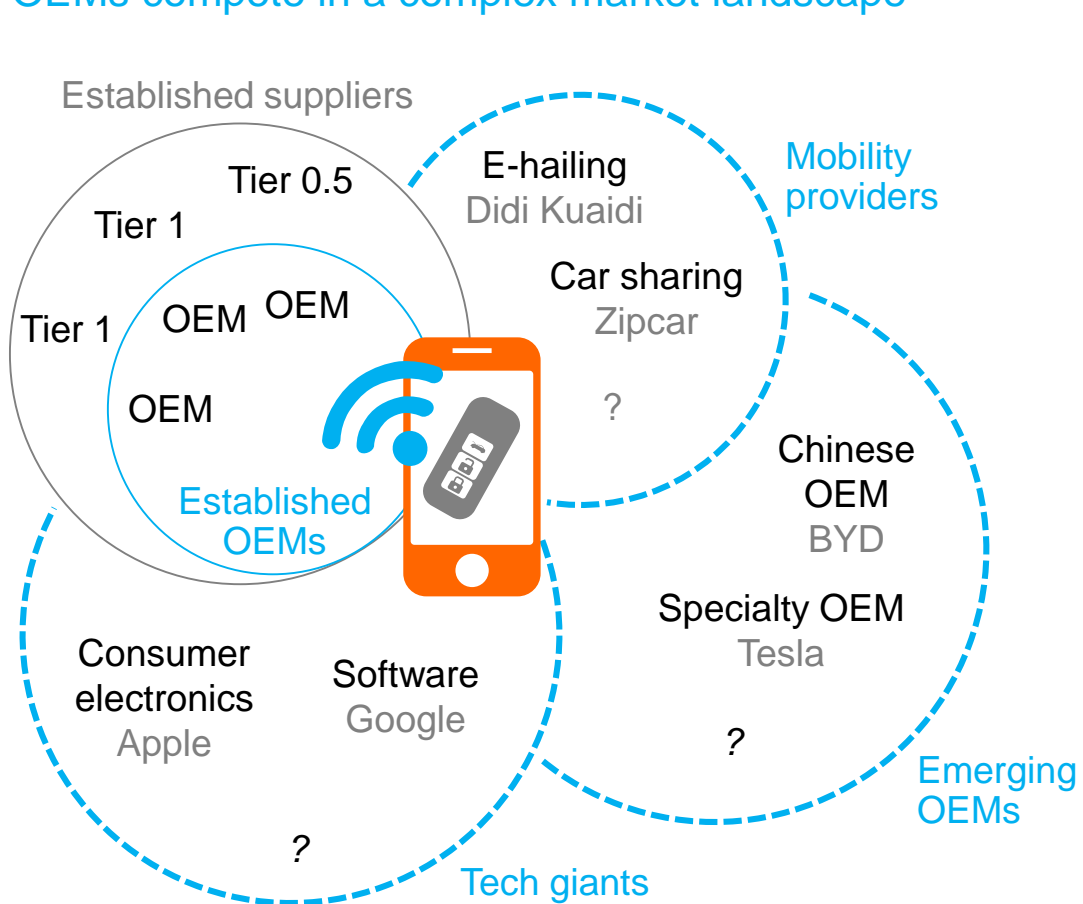
New market entrants are expected to initially target specific segments and activities along the value chain only before potentially exploring further fields

New entrants are more focused on their product portfolio and activities along the value chain, increasing the competitive pressure on established OEMs

ILLUSTRATIVE

Step along the mobility value chain

	Product portfolio	Design	Product development (hardware)	Product development (software)	Production	Sales	Service
Automotive OEMs Established global players	*Broad*	██					
Emerging Chinese players	*Broad/ focused*	██					
Emerging specialty players	*Focused*	████████████████████████				████████████████	
Tech giants New OEM entrants	*Focused*	██████		██████		██████	
New software entrants	*Focused*			██████			
Mobility providers New entrants	*Focused*						██████
Suppliers Tier 0.5 system integrators	*Focused*		██████████				

What now for the players in the automotive industry?

To become a driver of change and benefit from these disruptive forces, incumbent players need to make fundamental and strategically vetted decisions now

Prepare for uncertainty

Success in 2030 will require automotive players to anticipate market trends sooner and to explore new mobility business models and their economical and consumer viability

Leverage partnerships

OEMs, suppliers, and service providers need to partner across and beyond the industry to form open, scalable ecosystems

Drive transfor-mational change

Players must adapt their organizations to facilitate greater internal collaboration and reflect that software is the key enabler for innovation and new business models

Reshape value proposition

To retain their share of the automotive profit pool, OEMs need to find the right strategy for differentiating their pro-ducts and services, evolving the value proposition from "hardware provider" to "integrated mobility service provider"