POLITECNICO
MILANO 1863

Automotive e meccatronica:

le prospettive del veicolo autonomo

19 Sep 2019

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Global Trends in automotive industries

electrified

connected

shared

yearly updated

autonomous

Five trends transforming the Automotive Industry, PwC 2018

Global Trends in automotive industries

connected

- ✓ Vehicles will be **connected** to other **vehicles** (**V2V**) and **infrastructures** (**V2X**): more **information** and **safety**
- ✓ Vehicle **passengers** will be **connected** to the rest of the world: travelling time available for other purposes

Five trends transforming the Automotive Industry, PwC 2018

Global Trends in automotive industries

yearly updated

Vehicle models will be **updated annually** in order to integrate the latest hardware and software developments

- ✓ Overcome actual 5-8 years cycles of vehicle models
- ✓ **Affordable through sharing** vehicle fleets

Five trends transforming the Automotive Industry, PwC 2018

Global Trends in automotive industries

shared

Car sharing will be **more economically convenient** and **widespread**

- ✓ **Autonomous vehicle** allows a convenient "**on demand**" service
- ✓ Change in the behavior: vehicle as a service
- ✓ **More affordable** (no personal vehicles to buy, but services)

Five trends transforming the Automotive Industry, PwC 2018

shared

Some Hints

- ✓ 2015-2017 shared services grown +17% yearly
- ✓ 43% of cars in Milan, 24% Rome 15% Turin and 8% Florence
- ✓ Expected 30k in 2020

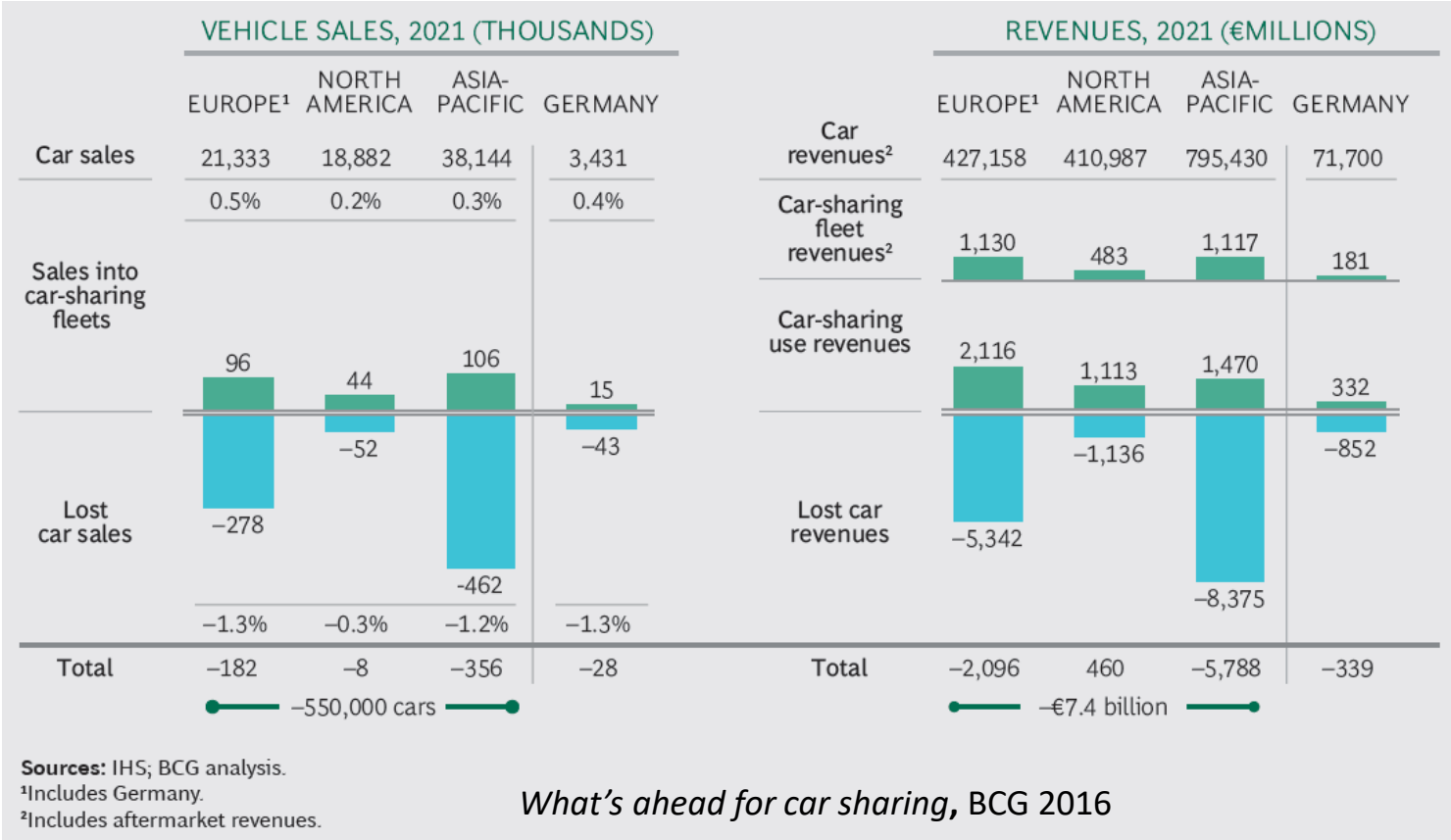
MILANO	2013	2014	2015	2016	2017
Veicoli	993	2.018	2.562	2.988	3.290
Iscritti	40.256	244.387	394.013	522.578	*639.000*
Noleggi giorno (media)	2.250	6.300	9.492	10.949	*15.000*
Noleggi giorno per auto	2,3	3,1	3,7	4	*5,1*

Fonte: Osservatorio Nazionale Sharing Mobility, AMAT

shared

Some Hints

- ✓ -550k Vehicles
- ✓ -7.4 € billion lost



What's ahead for car sharing, BCG 2016

Global Trends in automotive industries

electrified

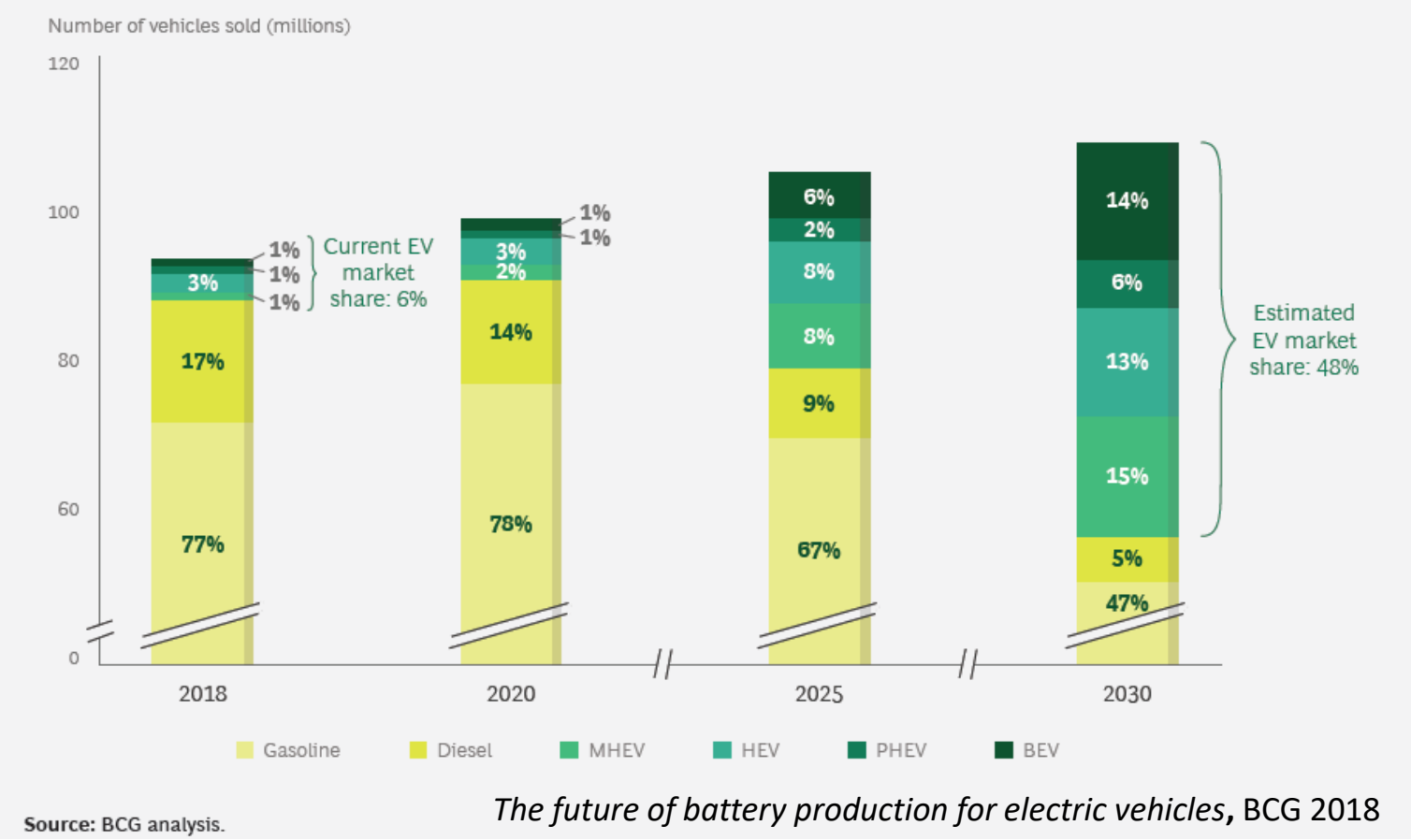
emissions-free mobility would hardly be possible without **electrification** of the drive train.

- ✓ Electricity used by vehicles will come from **renewable sources** to ensure **CO2-neutral mobility**.
- ✓ **No exhaust fumes**
- ✓ **Low noise**

Five trends transforming the Automotive Industry, PwC 2018

electrified

Open Issues



The future of battery production for electric vehicles, BCG 2018

In **2030** (from **actual 3%**) around **48%** of vehicles:

- ✓ 5kWh mild hybrid (15%)
- ✓ 10kWh Hybrid (13%)
- ✓ 18 kWh Plug Hybrid (6%)
- ✓ 110kWh Battery electric (14%)

electrified

Open Issues

BEV classification:

- ✓ **Urban**: small for short-range, standard charged overnight = 20%
- ✓ **Family**: medium size for intercity travels, 30-60min of charging at high voltage stations = 40%
- ✓ **Premium**: +500 km, 2 hour fully charged of +125 km in 15 min = 25%
- ✓ **Robo taxi**: fleet for urban transportation with fast charging (10-15 min) = 15%

The future of battery production for electric vehicles, BCG 2018

electrified

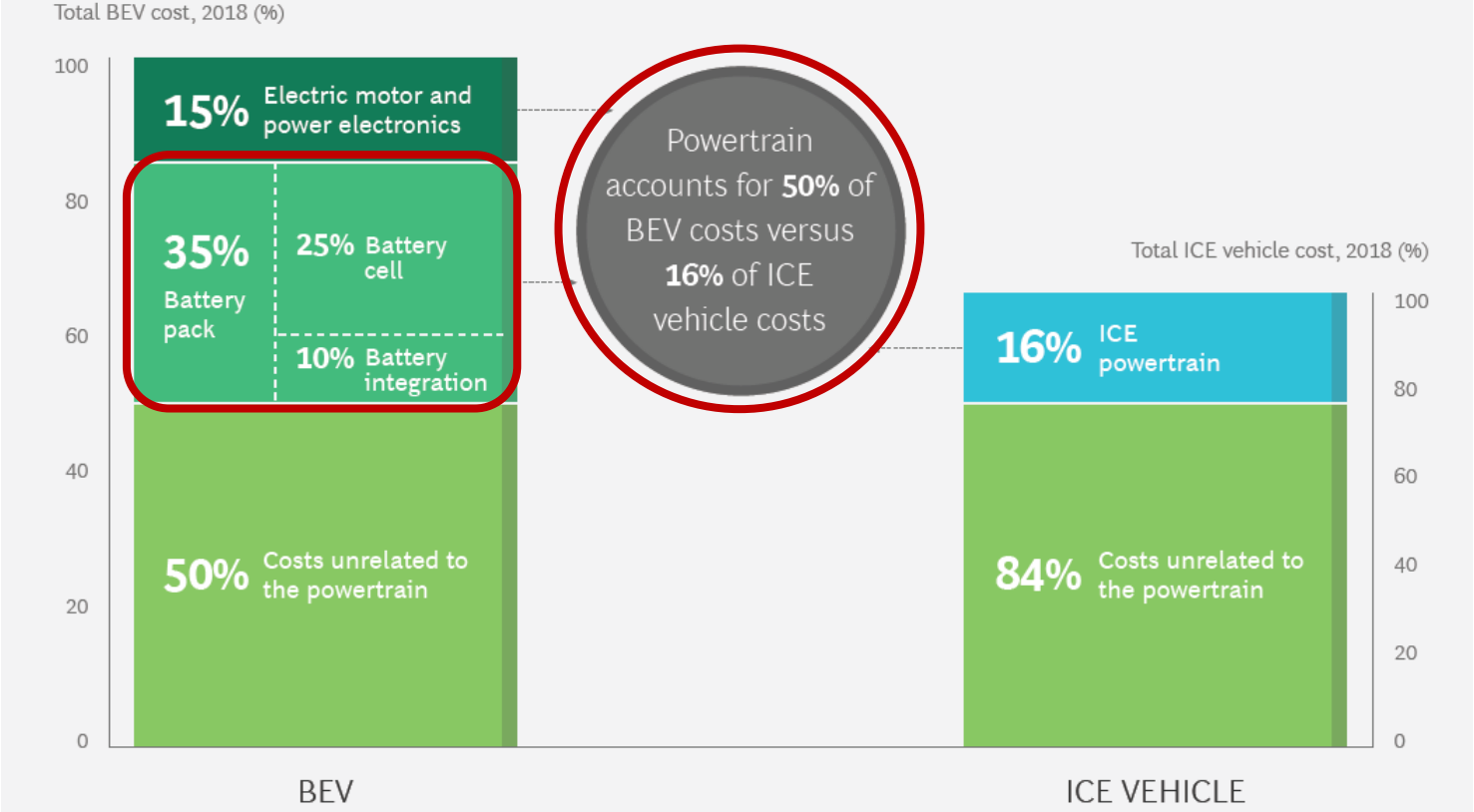
Open Issues

- ✓ **Capacity** for battery cell **will exceed** market demand **(growing)** by **40%** in **2021**.
- ✓ **Producers** will need to **slash price** by **reducing manufacturing cost**
  - ✓ **20% on KWh cost** by **20-35 % on each production step:** electrode production, cell assembly and cell finishing

The future of battery production for electric vehicles, BCG 2018

electrified

Open Issues



Sources: JPMorgan Chase; BCG analysis.
Note: BEV = battery electric vehicle; ICE = internal combustion engine. The electric powertrain consists of the electric motor, power electronics, and battery pack.

Global Trends in automotive industries

autonomous

- ✓ **Technological development** in term of sensing, actuation and control algorithms, makes the future development of a complete **autonomous vehicle possible**. This will be **disruptive** for automotive industry as well as for individual mobility.

- ✓ In last decades we assisted to a **progressive grown of vehicle's automation**, which has **exponentially accelerated** in last years.

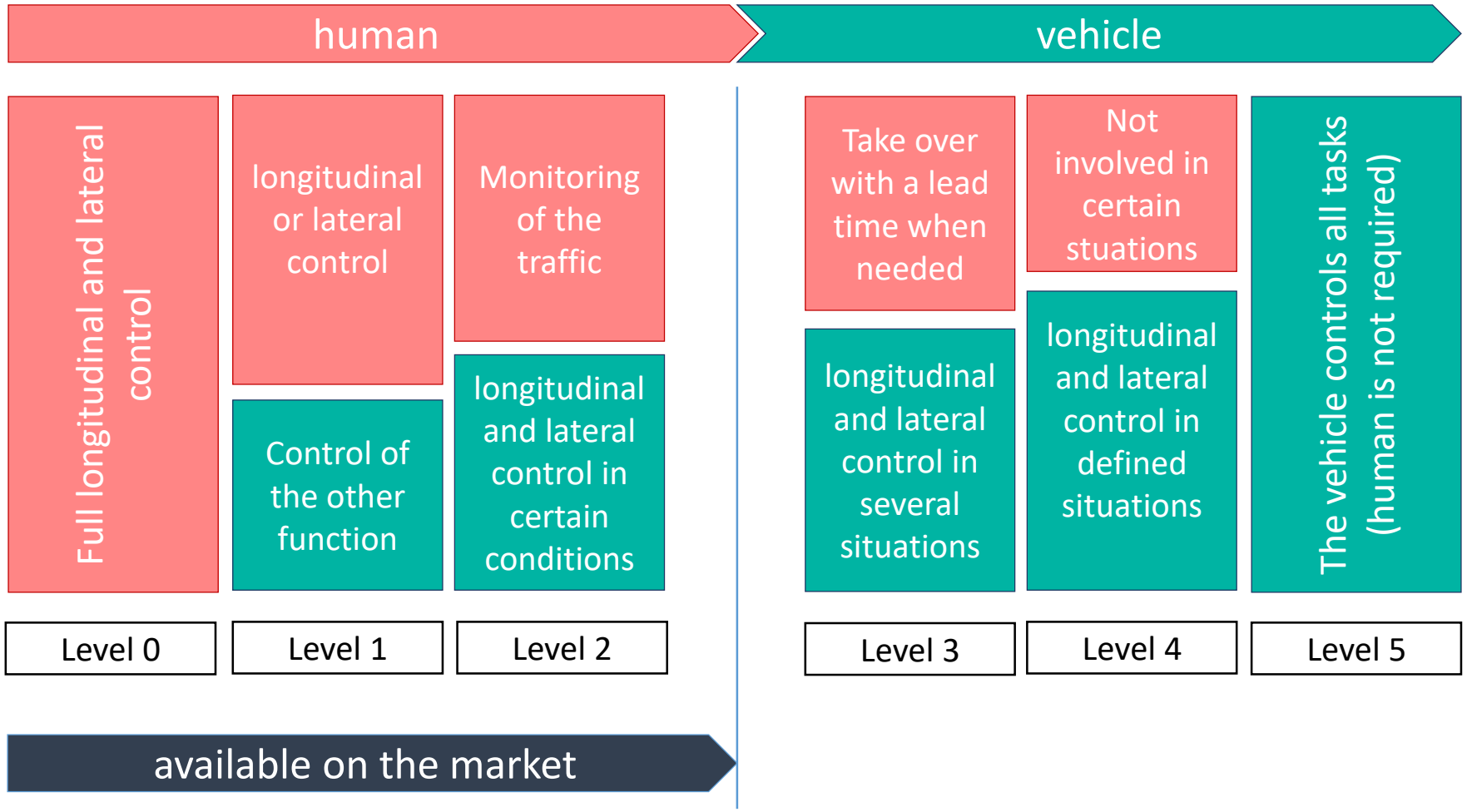
Five trends transforming the Automotive Industry, PwC 2018

Levels of driving automation – J3016

SAE (Society of Automotive Engineers)

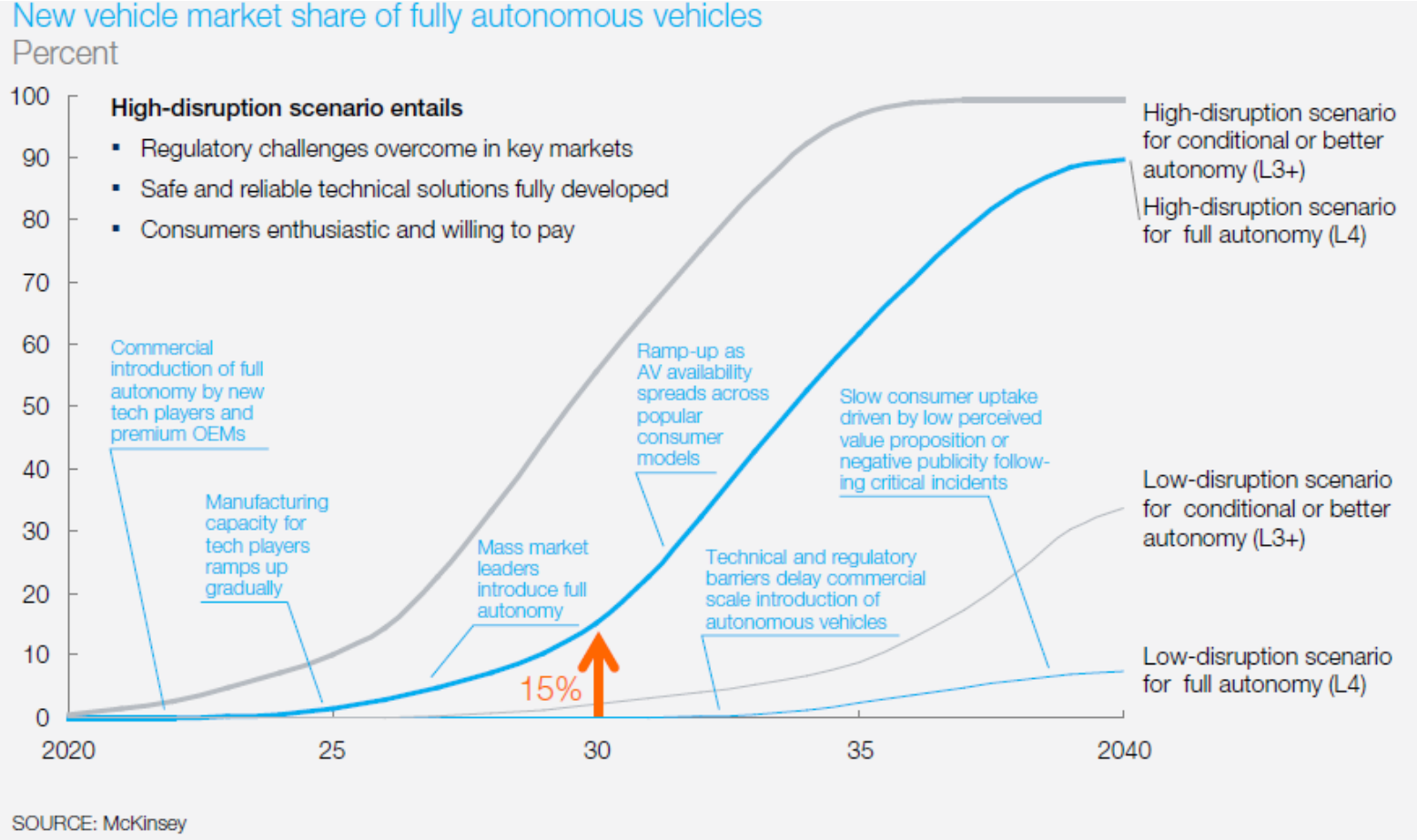
The intelligence level and automation capabilities of vehicles is ranked through **0 to 5** (from **fully manual** to **fully autonomous** capabilities).

Useful to describe the **full range** of driving automation features equipped on motor vehicles in a **functionally consistent** and **coherent** manner.


human
vehicle
Full longitudinal and lateral control
longitudinal or lateral control
Control of the other function
Monitoring of the traffic
longitudinal and lateral control in certain conditions
Take over with a lead time when needed
longitudinal and lateral control in several situations
Not involved in certain stuations
longitudinal and lateral control in defined situations
The vehicle controls all tasks (human is not required)
Level 0
Level 1
Level 2
Level 3
Level 4
Level 5
available on the market

autonomous

Prediction



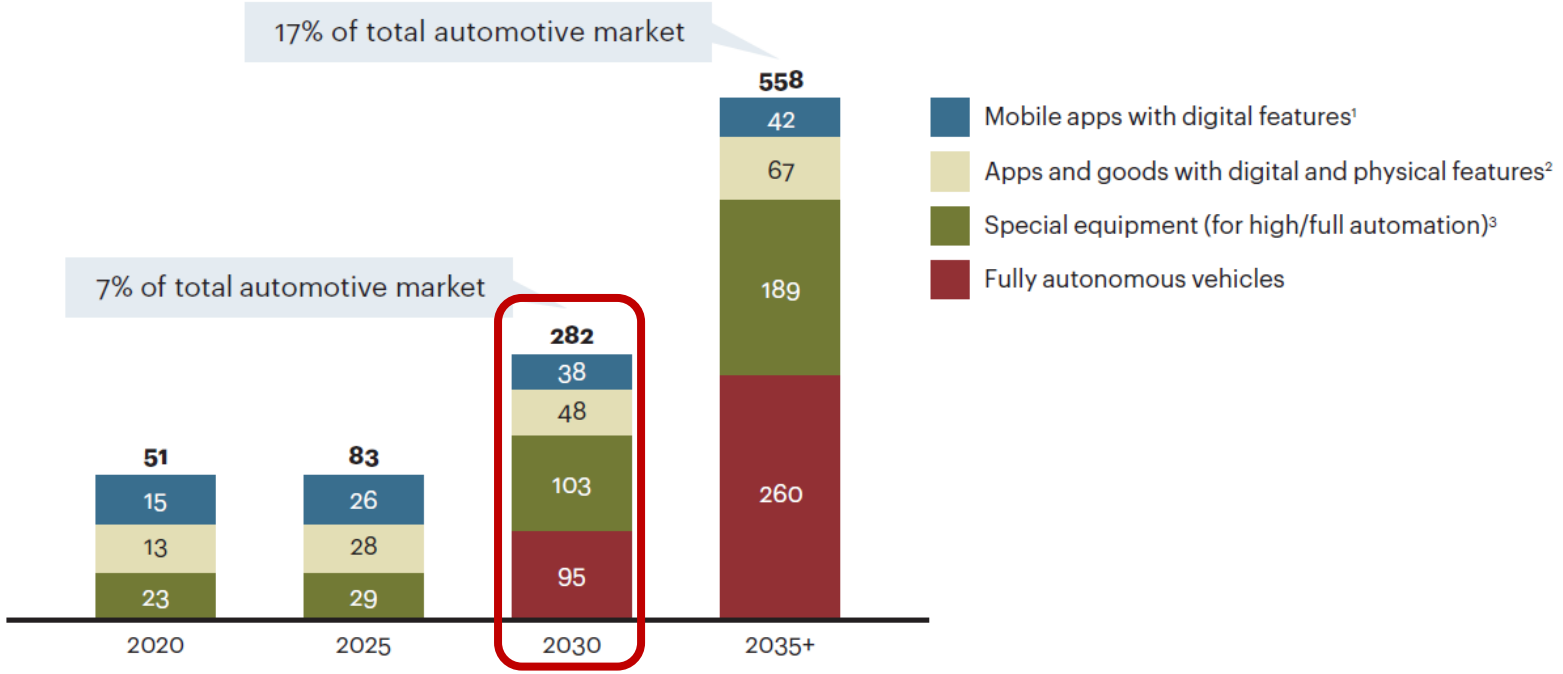
- ✓ **Difficult to make prediction**
- ✓ **High automation / AV can be up to 50 /15 %**

Automotive revolution – prospective towards 2030, McKinsey 2016

autonomous

Prediction

Global market for automated and autonomous driving, including related services
($ billion)



¹ Content and software for autonomous driving
² Telematics features for car-to-car and car-to-x communication and traffic management
³ Accessories for assisted driving, auto pilot, navigation, and more
Sources: IHS Automotive, Berylls Connectivity Compass 2014, Factiva, Just Auto; A.T. Kearney analysis

- ✓ **Special equipment** (onboard control, guidance and communication) : **103 $ billion**
- ✓ **Mobile apps** for telematics and communication for **V2X : 89 $ billion**
- ✓ **Fully AV** (from late 2020) : **95 $ billion**
- ✓ **<u>All told</u> : 282 $ billion/year by 2030**

How automakers can survive the Self-Driving Era, ATKearney 2016

autonomous

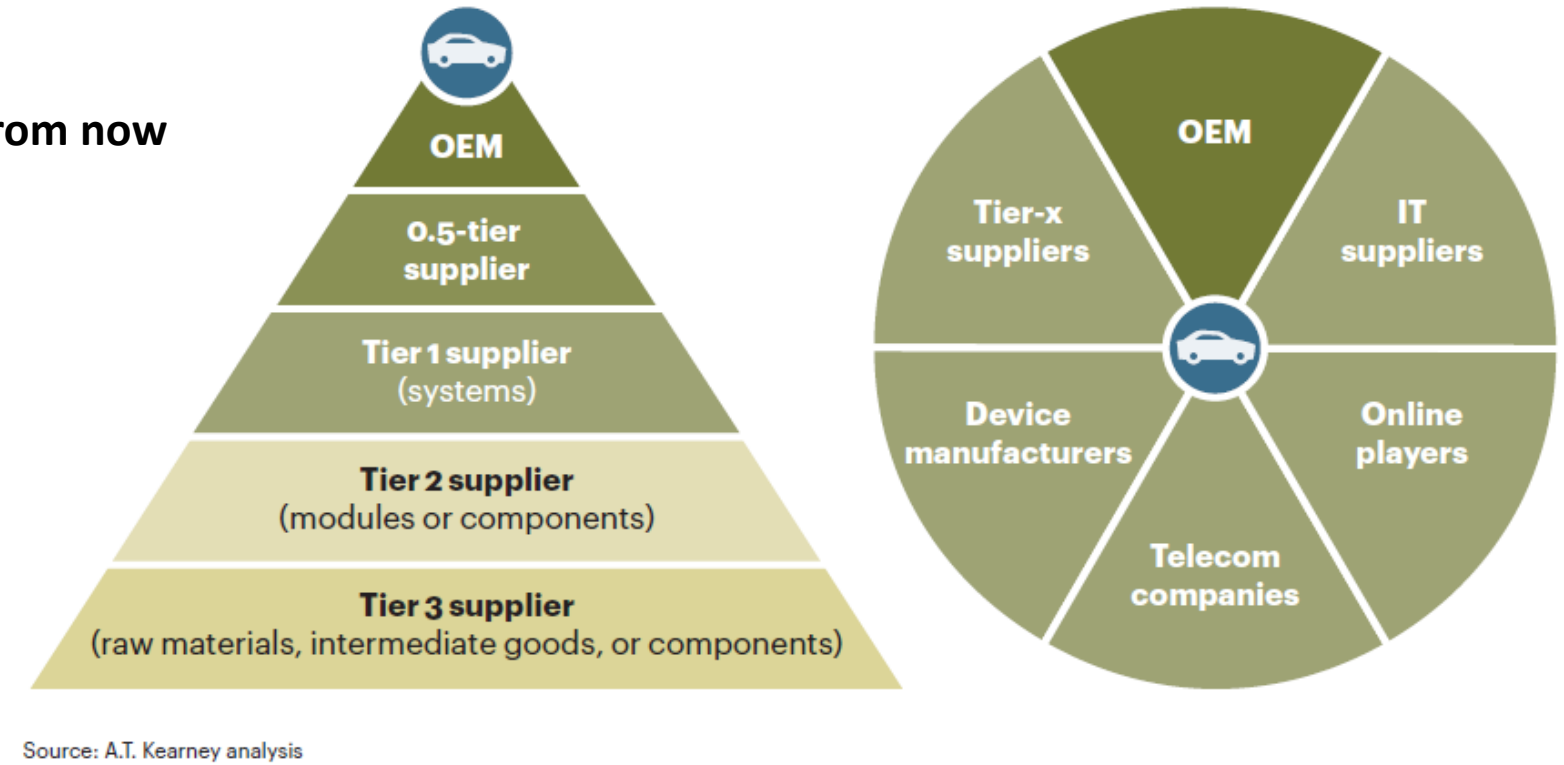
From a pyramid to hub-and-spoke 15 years from now

Partecipants:

- Multibilion $ companies
- Strong R&D teams
- Regional/global leadership position

(i.e: Microsoft, Google, SAP, Samsung, Siemens, …)

Autonomous driving will disrupt the automotive industry



Source: A.T. Kearney analysis

How automakers can survive the Self-Driving Era, ATKearney 2016

autonomous

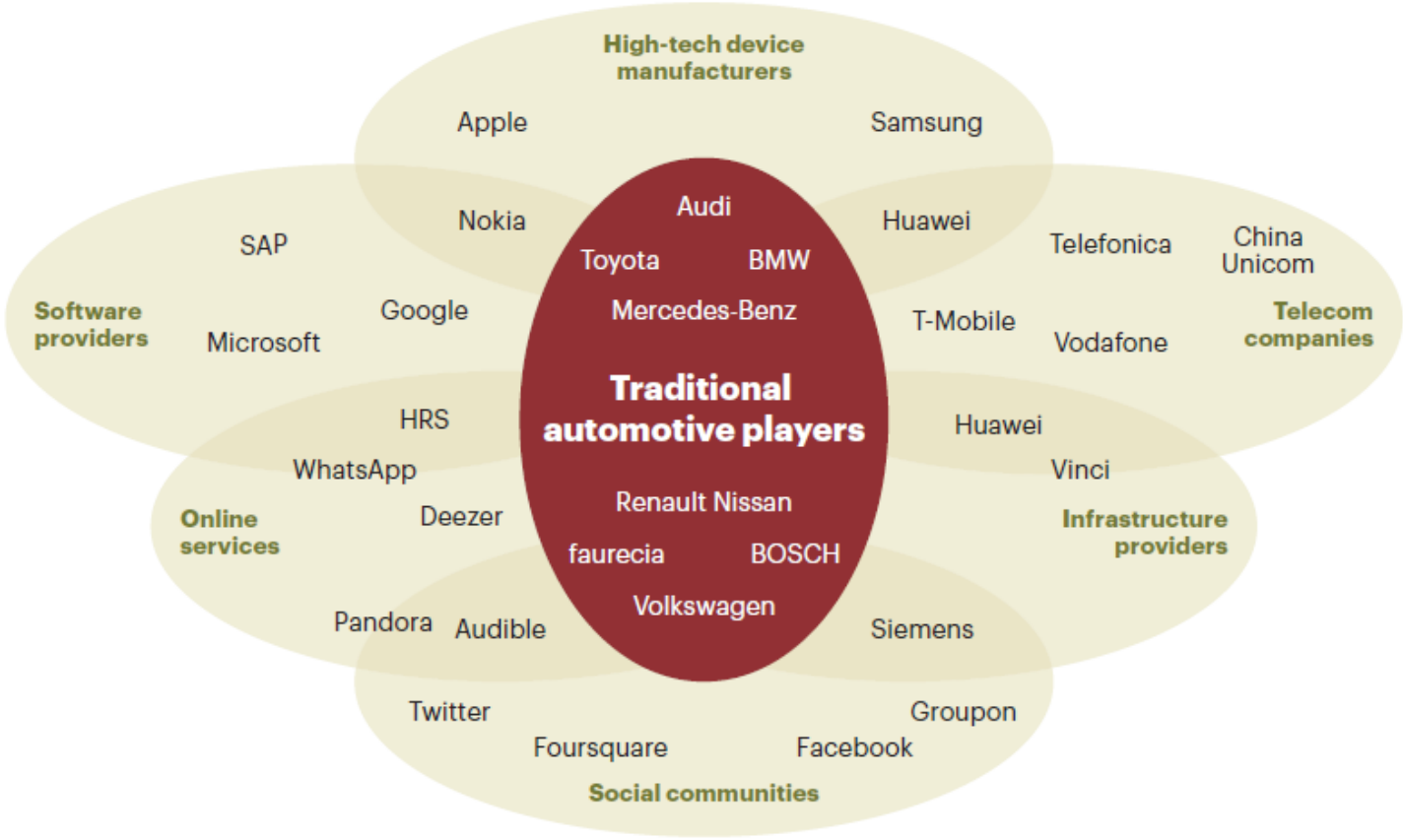
From
90% Hw 10% Sw

to
40% Hw 40% Sw 20% Contents

… more opportunities?

Companies will join forces to create powerful ecosystems

Non-exhaustive



Source: A.T. Kearney analysis

autonomous

Open Issues

Not only Technological development is a limit to AV adoption.
Other issues (and jobs) required

✓ **Traffic Regulation**	AV allowed if human driver not responsible for its operation?
✓ **Liability Laws**	who is responsible in accident/malfunction of AV?
✓ **Standards**	define performance standards and testing procedures to ensure safety and cybersecurity of AV

BCG, 2018

Thanks for your attention

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