TÜBİTAK
MAM

TUBITAK | MARMARA RESEARCH CENTER

January, 2019

SCIENCE TO TECHNOLOGY
TECHNOLOGY TO INDUSTRY

Transition to Autonomous and Connected Vehicles

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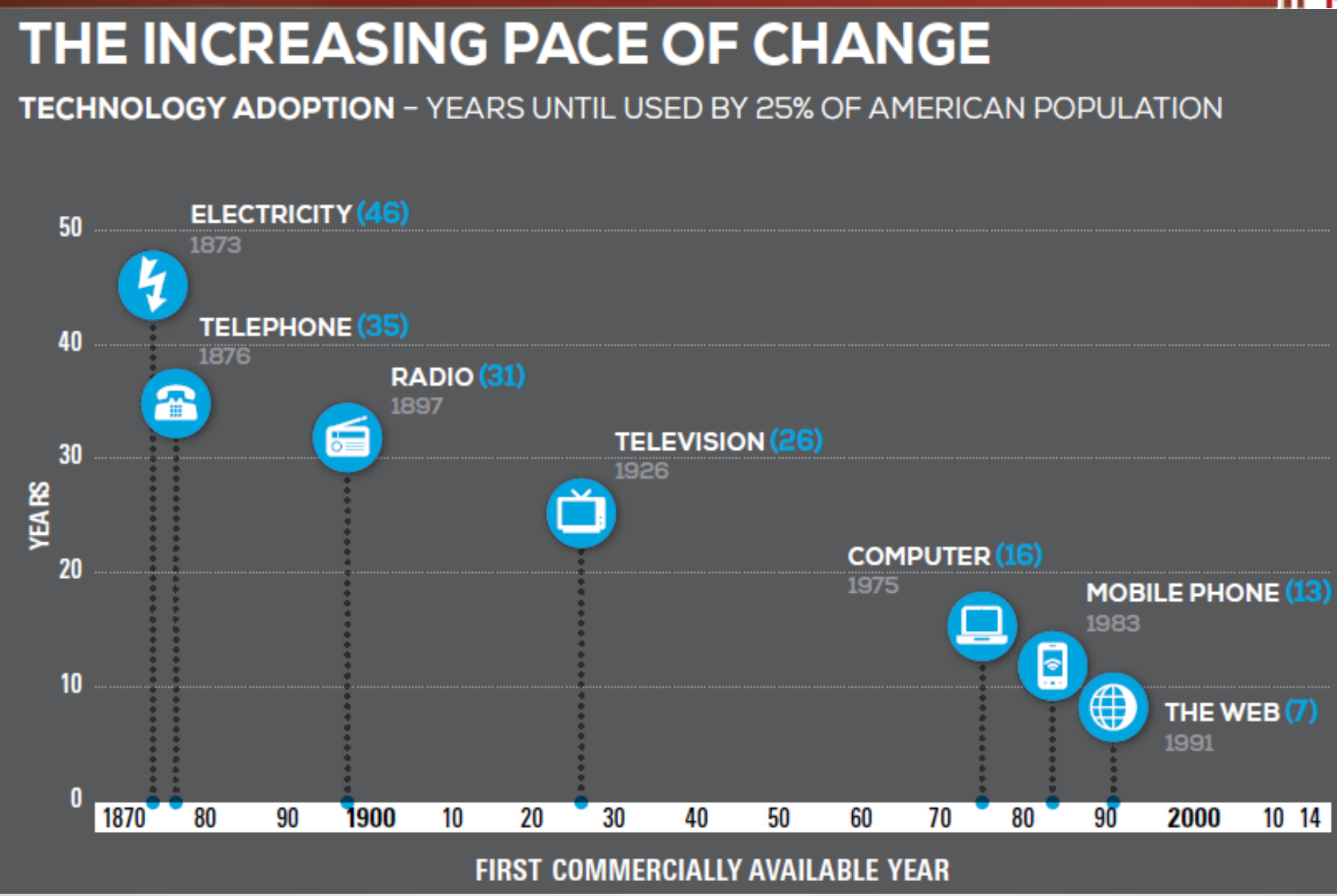
The Frequency of Disruptive Technologies

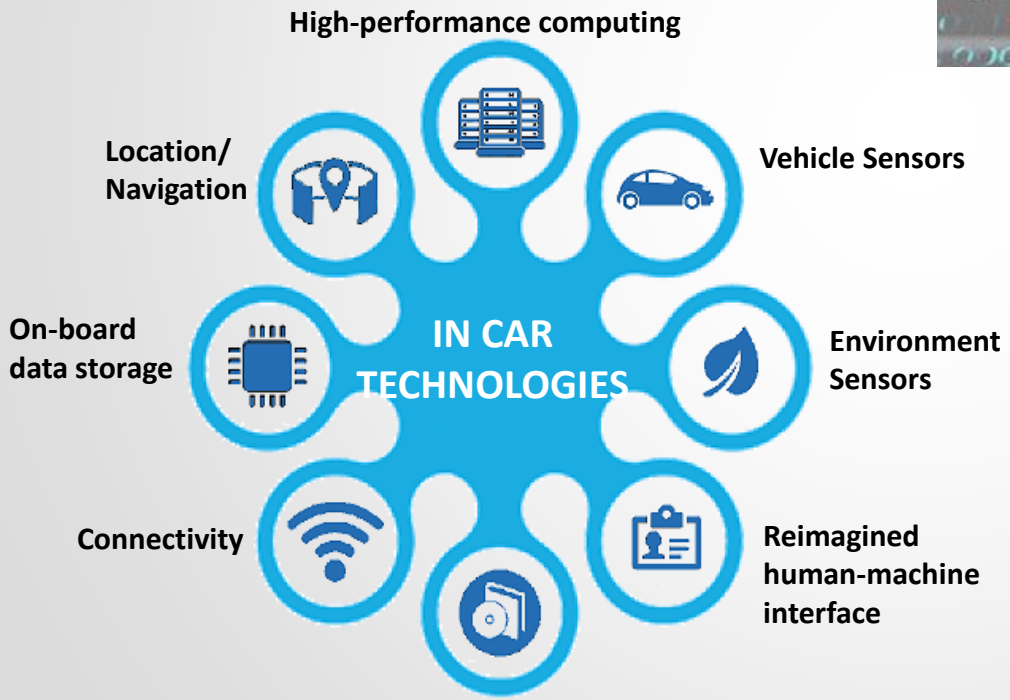


Source: CA ANZ, future[inc]

Breakthrough Technologies

Electromobility

Alternative Energy Sources

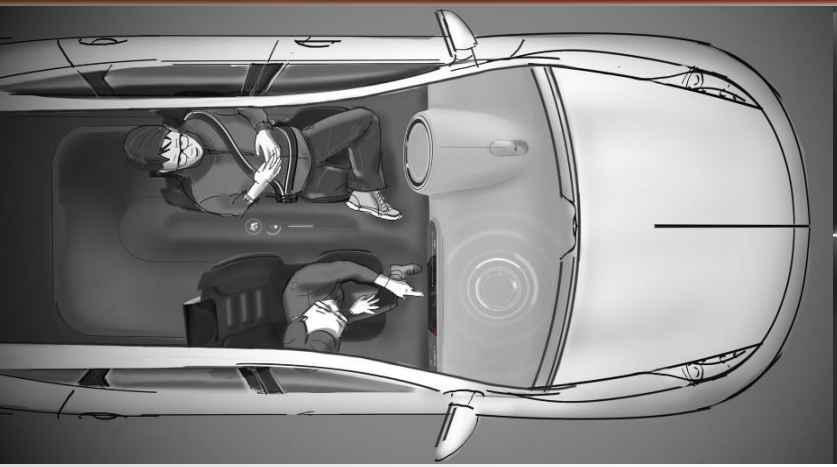


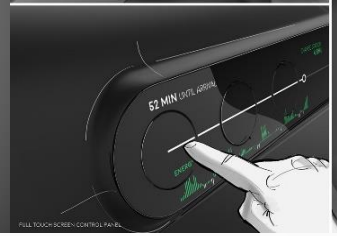
Collaborative Data Monetization

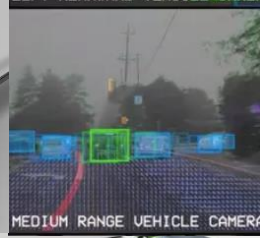
Machine Learning

Image courtesy of of McKinsey, Smart2Zero, Deloitte

Autonomous Vehicles







- **Simplified User Controls**
- **Advanced Driver Assistance Systems**
- **Autonomous Drive**

ACCELERATING INTO THE FUTURE

By 2035, the annual global sale of fully autonomous vehicles might be more than **12 million.**

By 2035, partially autonomous vehicles can have an annual global sale of **18 million.**

From 2025 to 2035, the market for partially and fully autonomous vehicles is expected to grow between **$42 billion** and **$77 billion.**

By 2035, **25%** of the new car market might be captured by autos with autonomous vehicle features.

Vehicle Connectivity

Fewer driving fatalities/injuries

>1.2M

More predictable, productive travel

3.1B

Less greenhouse gas emissions

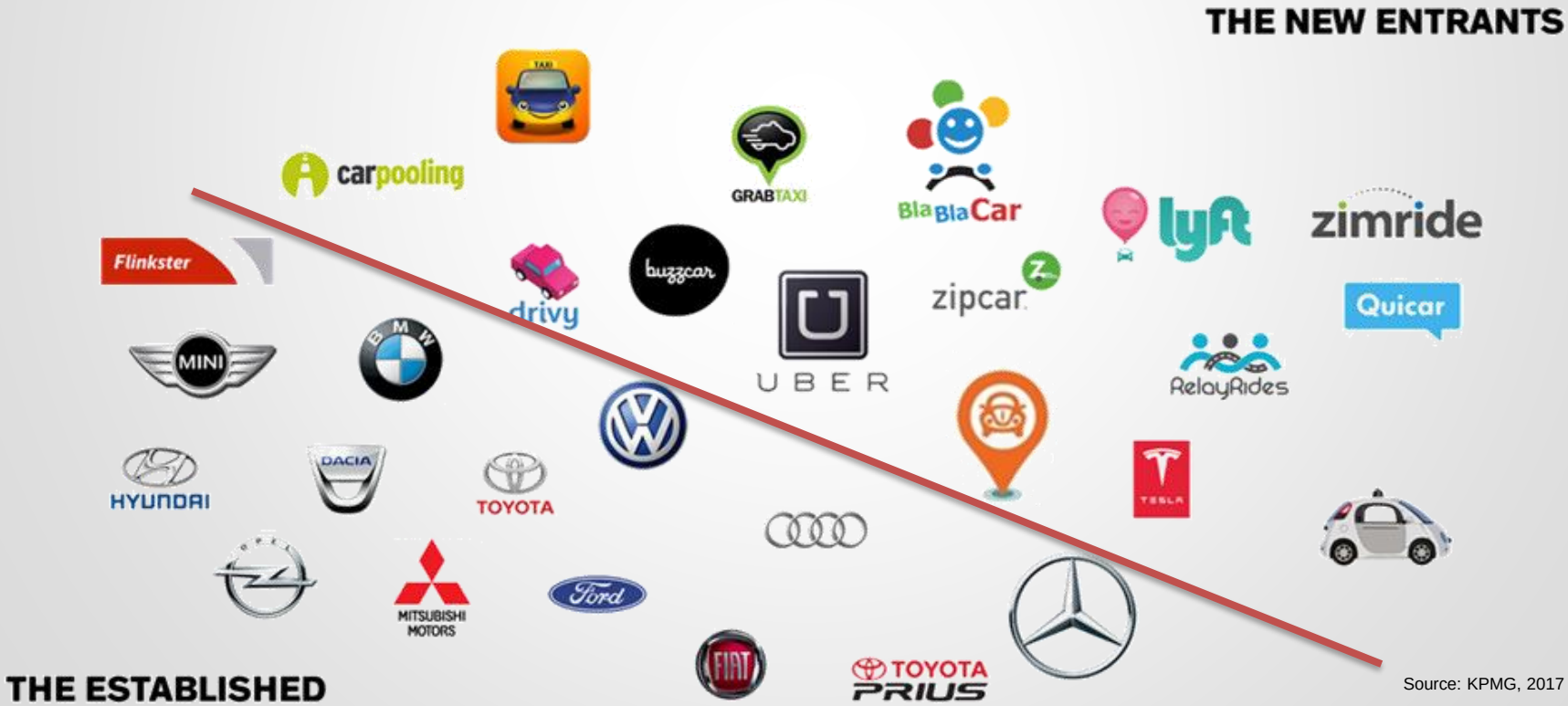
14%

McKinsey, 2016 and Qual

Future of Mobility

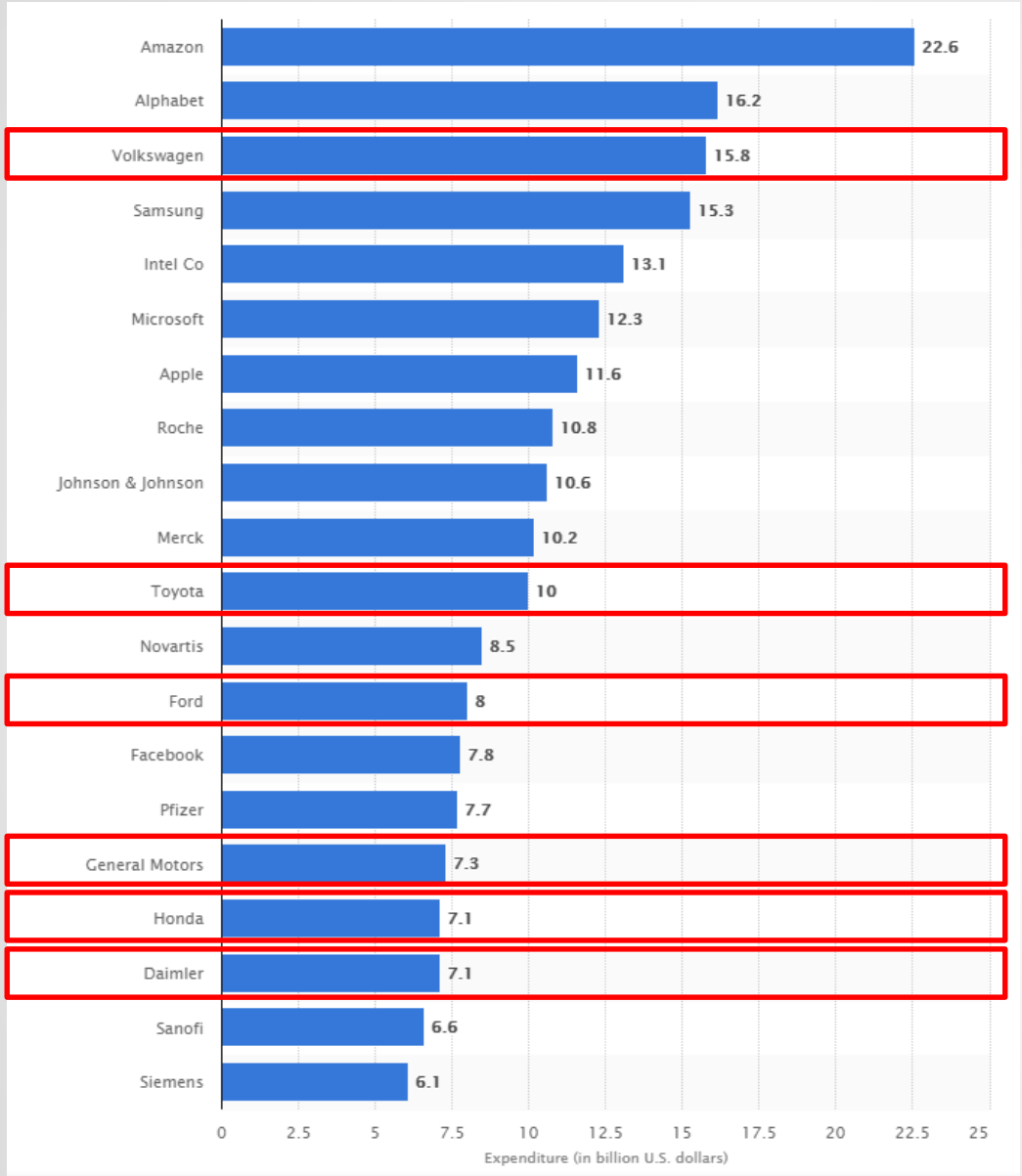
"The auto industry is poised for more change in the next five to ten years than it's seen in the past 50."

"For more than 100 years the automotive industry has created competitive advantage mainly through engineering excellence. Going forward, this will no longer be sufficient."



Source: KPMG, 2017 – DUP, 2015

World's Top 20 R&D Spenders



In the World's Top 20 R&D Spenders there are 6 automotive OEMs.

Source : Statisca 2019

Technology Developers

BOSCH

MOBILEYE An Intel Company

Continental The Future in Motion

WABCO

Autoliv

HELLA

KNORR-BREMSE

Valeo

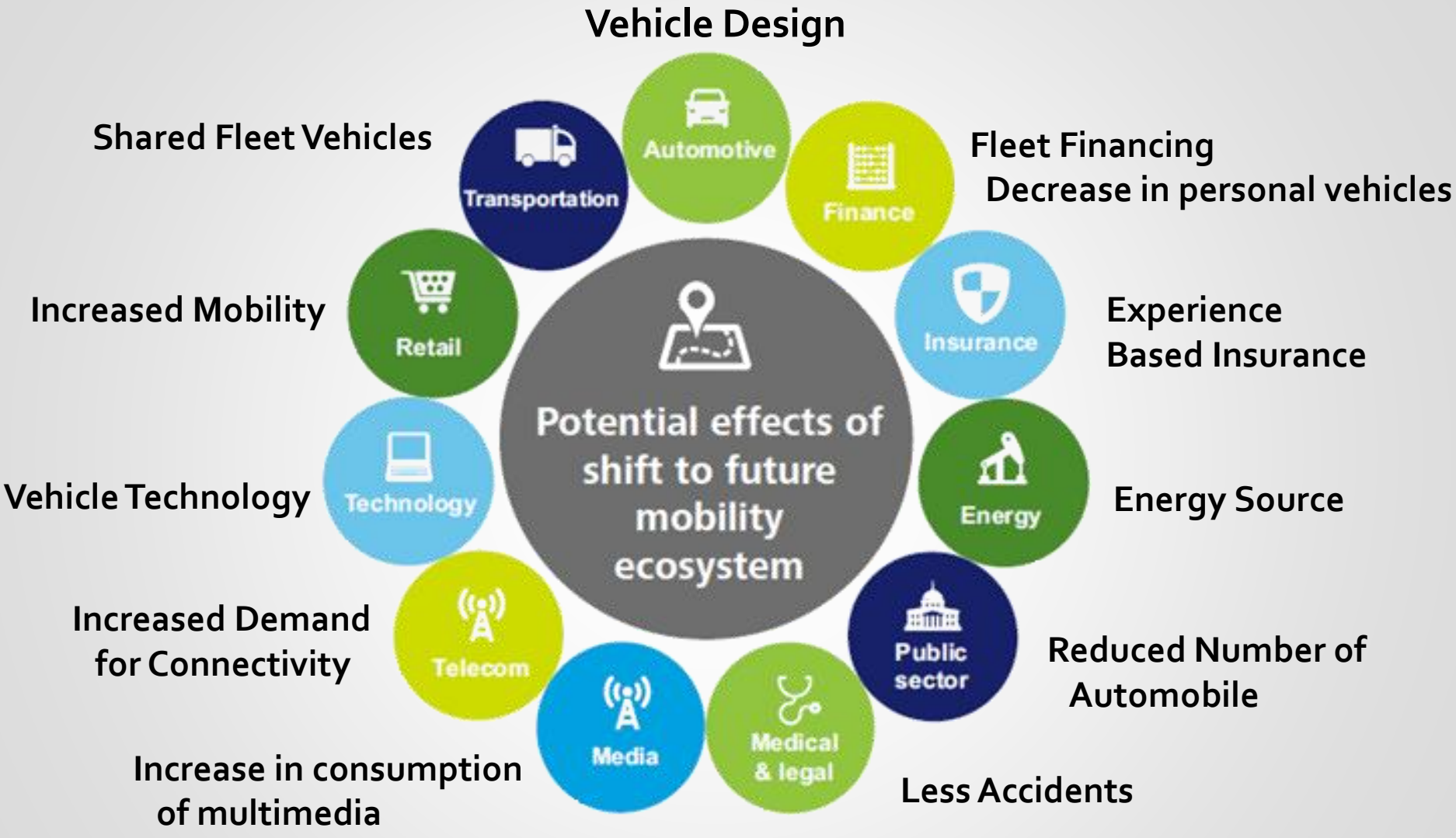
LG Chem

SAMSUNG

ZF

Image: Volvo

Implications of Transition



Source:, The future of mobility, Deloitte University Press

Potential Barriers and Setbacks

❑ Technological Barriers

- Potential Component Level Mulfunctions
- Protection against cybersecurity threats
- Data theft and sabotage risks

❑ Standardization / Regulatory Setbacks

- Development of technical strandards
- Improving highway infrastructure
- Having up-to-date and accurate maps
- Clarification of legal liabilities
- Regulatory Approval Procedures

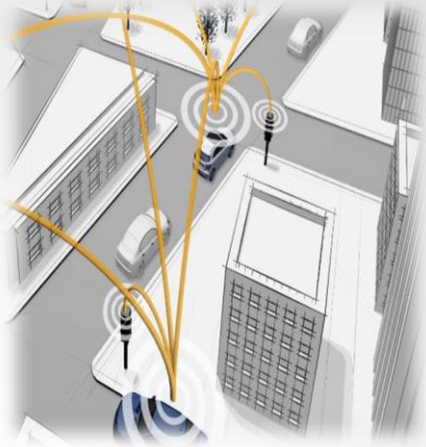
❑ Customer Concerns

- Assurance of safety & reliability
- Vehicle purchase cost
- Potential loss of privacy
- Ethical issues

«Drivers shouldn't have to choose between being connected and being protected»

Image courtesy of of Intel, McKinsey, Mcafee

Smart Mobility Clustering



Electromobility	Autonomous Vehicles	V2X	Smart Transportation Management
• Powertrain • Chassis • Interior, Exterior • Body • Energy Storage Systems • Vehicle Integration • E-Charge	• Advanced Driver Assistance Systems • Autonomous Vehicles • Hardware Development • Control Algorithm	• Hardware Development • Software Development • Communication Protocols	• Big Data • IoT • Planned Public Transportation

TUBITAK MRC

In TUBITAK MRC, we have been working on electric vehicle technologies in the past 15 years as being the only institution that have the associated experts and infrastructure in the country.

Excellence Centers

- Hybrid and Electric Vehicle Excellence Center
- Automotive Excellence Center
- Engine Excellence Center

Infrastructure

- Active Material Development Labs
- Battery Testing Systems
- Electric Motor Dynos
- Electronic Design and Testing Labs
- Internal Combustion Engine Dynos
- Climatic Dual Axle Chassis Dyno
- Emissions Test Labs

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THANK YOU

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