McKinsey & Company

McKinsey perspective on Robo Taxi and Private AVs

eMonday Kongress | June 2020

Introduction

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– What we do

Leading think tank and advisor in the mobility industry

Think tank with a clear voice in the industry

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Agenda

1

Introduction: Mobility Market Model (M^3)

2

Key insights from the Mobility Market Model

3

Implications from Covid-19

4

10 timeless tests for AV strategy

Mobility Market Model projections are built using several modules that shape future scenarios

Macroeconomic PMT forecast

City-level forecast of vehicle and public transit miles driven based on macroeconomic factors – population, GDP, income levels etc.

Technology Addressability

Addressability of vehicle miles traveled at city-level by AV

TCO by modes

Detailed total cost of ownership for several transportation modes

Consumer preferences

Region-level insights from consumer surveys on adoption and switching behaviors

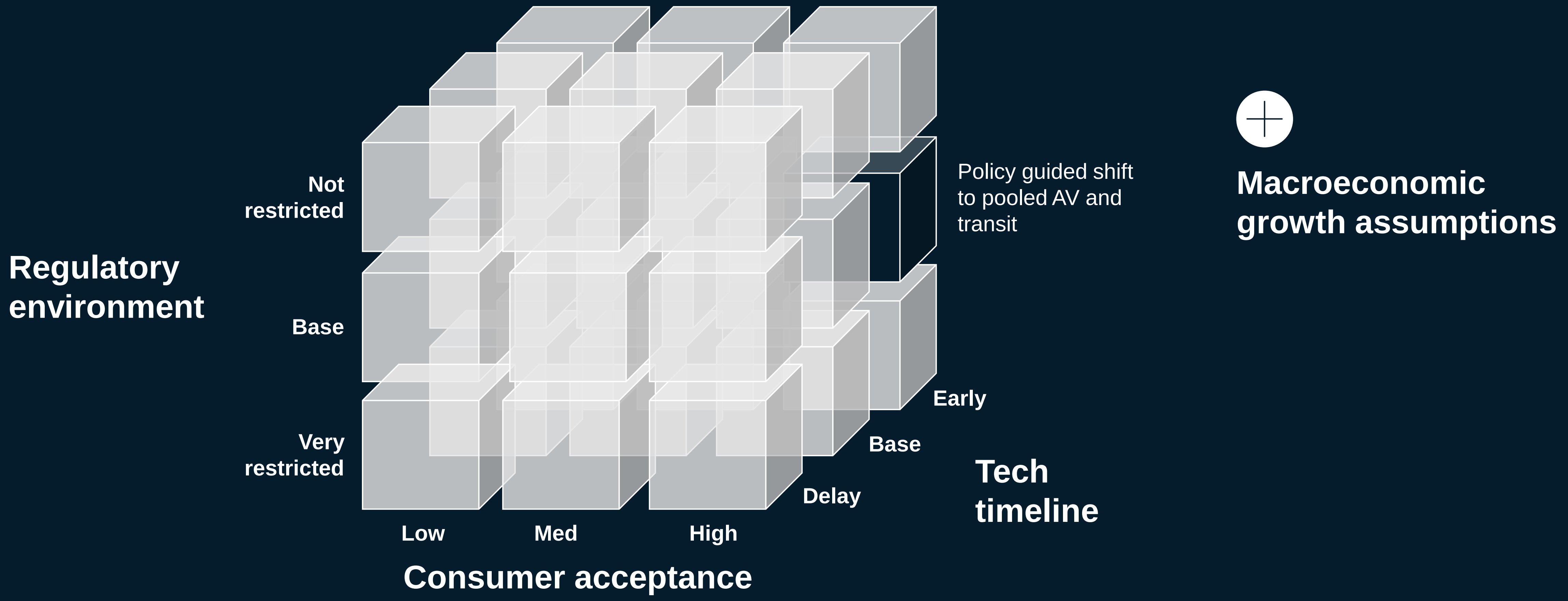
Mode selection logic

City archetype-level growth and conquest of passenger miles traveled by new mobility modes

Source: McKinsey Center for Future Mobility

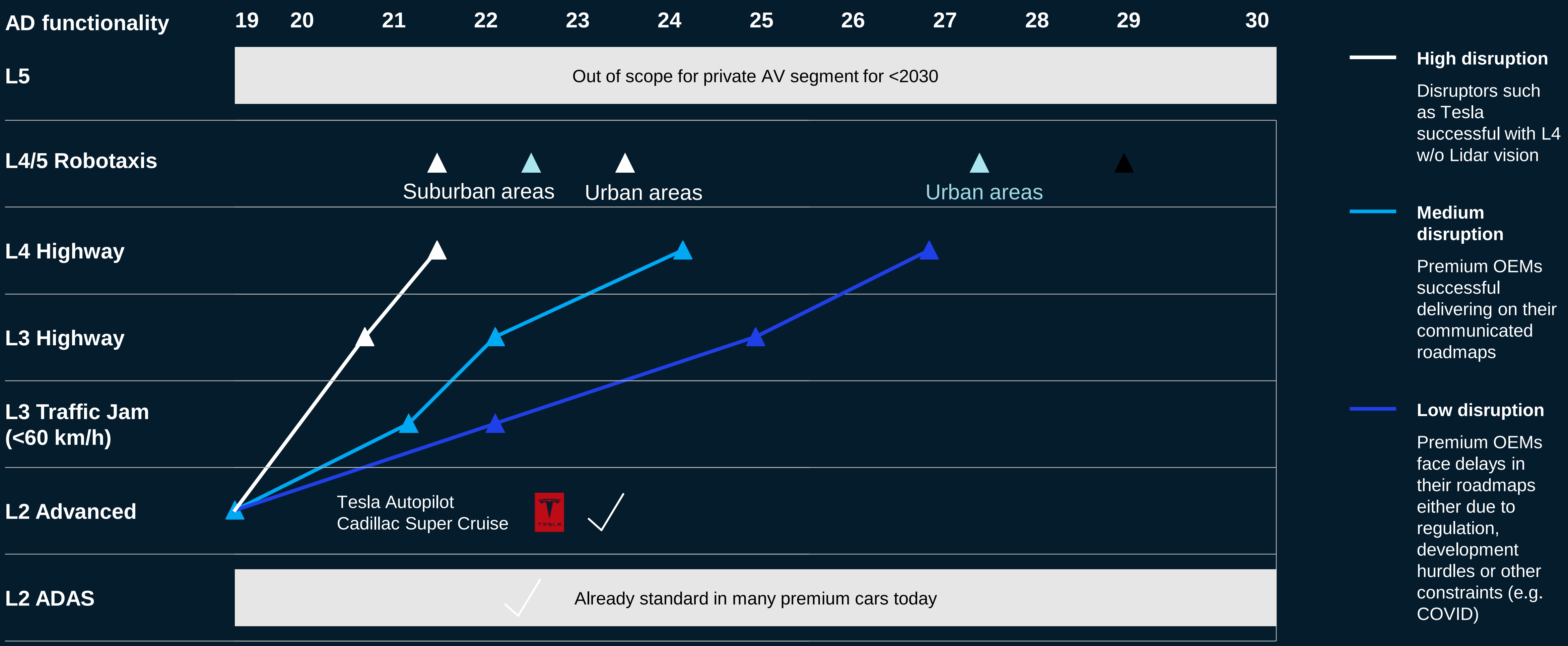
We see 4 main driver for the future of mobility: Regulation, Consumer acceptance, Tech readiness and machroeconic growth

Mobility Market Model – Scenarios



Source: McKinsey Center for Future Mobility

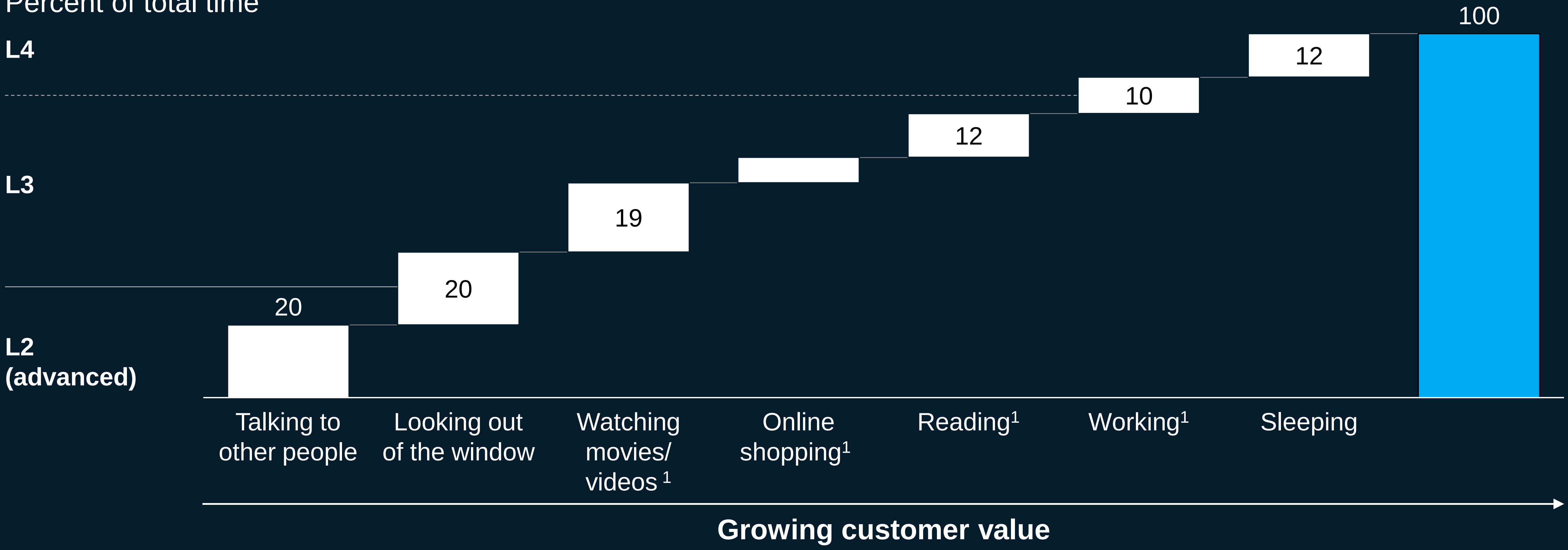
High uncertainty in the tech time line driven due to regulation, development hurdles, and willingness to invest



Source: McKinsey Center for Future Mobility

The customer willingness to pay will depend on possible activities while driving, which are dependent on the regulatory situation

Conceived distribution of time spent while autonomous driving mode is active
Percent of total time



1. Could be feasible with L3 if done through MMI; potentially requiring L4 if own device to be used

Source: McKinsey Future Mobility Survey 2019

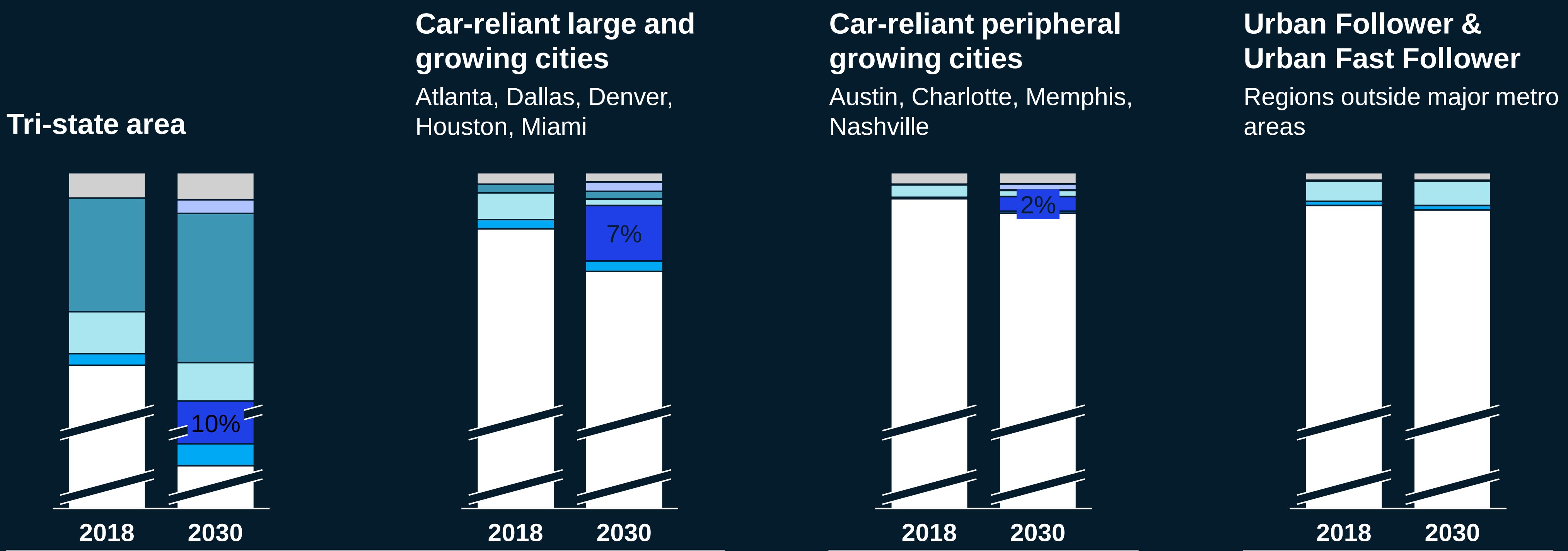
North American cities could see more muted disruption to mode share and private vehicle usage from new mobility modes

Total Passenger Miles Traveled, Trillions of miles, %

Other[1] | Shared Micromobility | Public transit – rail | Public transit – bus | New modes[2] | Taxi/e-hailing | Private vehicles

North American modal share by selected city archetypes

% of PMT, “Policy-guided shift to pooled AV and transit” scenario



Sample drivers

New modes take share from private vehicles and bus

Some disruption to bus and private vehicle usage

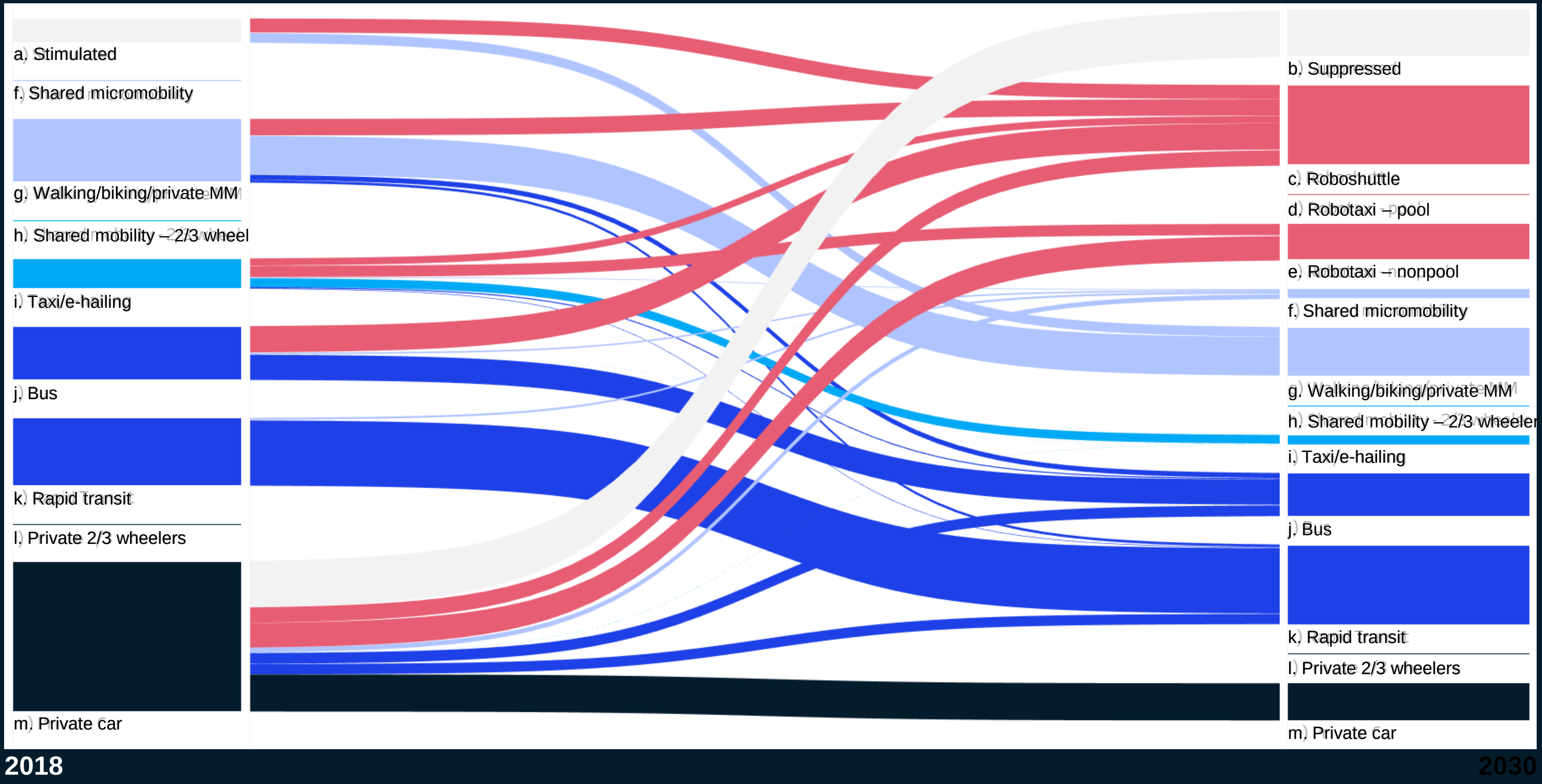
No real disruption to mode share

1 “Other” includes walking, biking, private micromobility, 2/3 wheelers
2. New modes includes Roboshuttle, Robotaxi (pooled), Robotaxi (non-pooled)

Source: McKinsey Center for Future Mobility

Example: In London emerging AVs will cannibalize miles travelled by other private and shared modes due to regulations

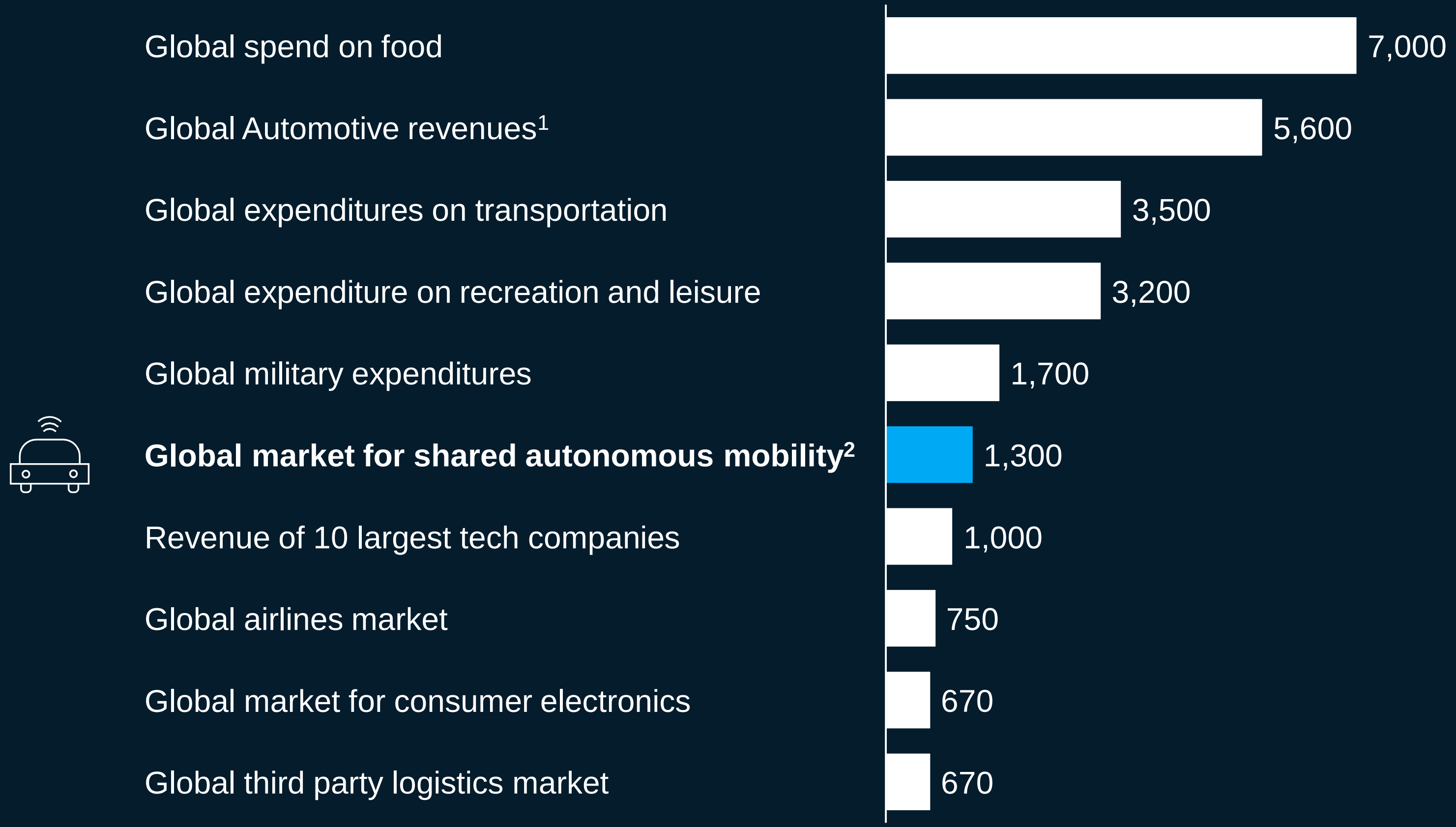
Mode share conversion in PMT, London, from 2018 to 2030, Policy-guided shift to pooled AV + transit



Source: McKinsey Center for Future Mobility

By 2030, shared autonomous mobility market will be among the largest revenue pools in the world

Potential revenue for shared autonomous mobility in 2030, USD billions



1. Includes one-time vehicle sales, aftermarket, shared mobility
2. Roboshuttle, Robotaxi non-pooled, robotaxi – pooled. Excludes base vehicle and incremental AV hardware, revenue

Source: McKinsey Center for Future Mobility

AV components, basic operations and mobility platform as largest revenue pools in 2030

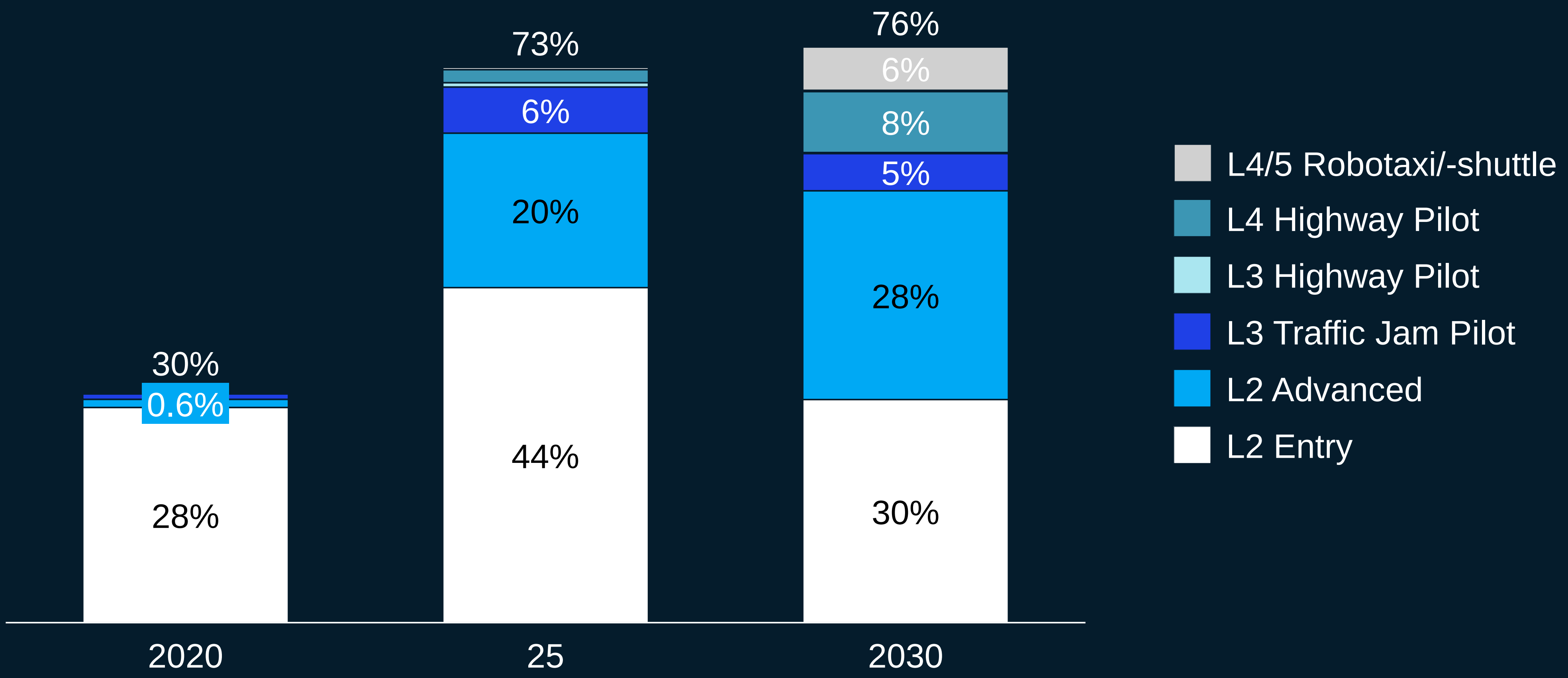
Potential revenue pools by 2030

	Components provider chain		HD map	Vehicle manufacturer chain	Asset provider chain	Operations chain		AV services chain	
	Traditional components	AV compo-nents	HD map & services	Base vehicles	Financing/as-set ownership	Basic operations	AV system operations	Mobility platform	Meta/aggrega-tor platform
Player examples	ZF, BOSCH, Continental, BRIDGESTONE	intel, NVIDIA, WAYMO, BOSCH, Continental	here, TOMTOM	BMW, GM, VW, TESLA	VOLKSWAGEN BANK, LeasePlan	CAR2GO, ATHLON, AVIS, Hertz	WAYMO	Uber, via, DiDi	moovel, Google Maps
Revenue pool bn USD	~100	~80	~90	~160	~60	~190	~180	~390	~40

Source: McKinsey Center for Future Mobility

Strong growth of L2 entry features until 2025 driven by regulation–then continuous replacement by higher levels of AD

Annual vehicles sales by AD feature



1. L2 and above, excluding Robotaxis

Source: McKinsey Center for Future Mobility

We expect impact of COVID-19 on the ACES to differ by trends in the short-term – no major changes in the mid-term outlook …

↑ Trend intensified ↓ Trend slowed down → Trend comparable to pre-COVID

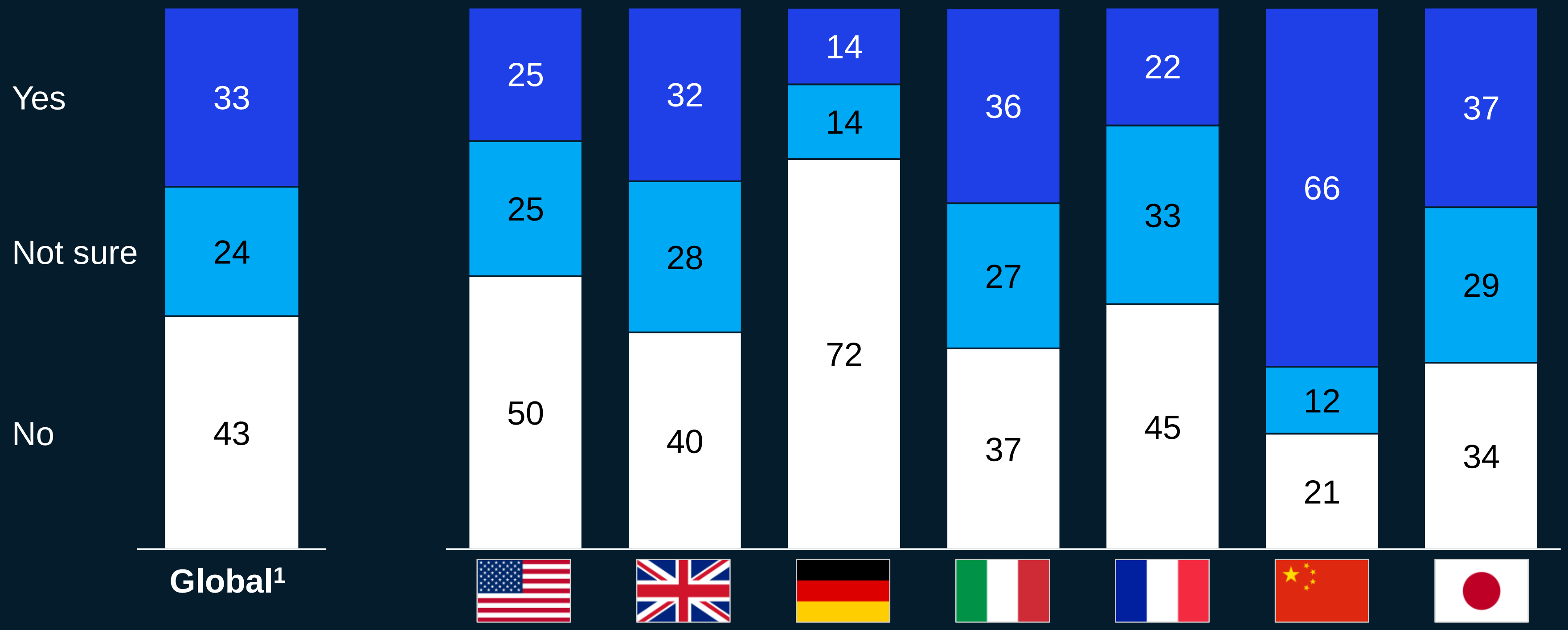
	Short-term		Mid-term	
Autonomous	↓	Testing temporarily **suspended**; OEM investments expected to **slow down**	→	**Delay in development** (“months”) **partial consolidation** to be expected, eventually increase in **cooperation,** however importance still high (e.g., contactless delivery)
Connectivity	→	**Limited impact** expected as many programs have already been decided and will not be halted	→	Consolidation in the startup and software tech space provide **chances to acquire talent or players** (esp. for OEMs); “**buy” more likely than build”** for OEMs
Electrification	→	EV market share **slightly higher** than Pre-COVID fueled by new incentives (CN, EU) and OEMs fulfilling CO_2 targets (EU), with **regional slow-down** (esp. in parts of the US)	→	EV sales **back to pre-Covid projections** by 2022 in **EU and CN**; **Uncertainty in the US**, depending on future regulatory landscape & oil price development
Sharing	↓	**General slow down expected** (Demand drop expected to recover not before mid 2021, financial pressure on start-ups, regulations focused on social distancing), small modifications to reduce risk of infection (e.g., face masks, riders required to sit in back seat)	→	Consolidation expected by **M&A activities** (esp. in micromobility), while cities might not take back all **restrictions for private vehicles**

Source: McKinsey Center for Future Mobility

Our consumer survey shows increasing importance of autonomous driving in times of Covid-19

Preliminary results of first wave as of May 9-18

Do you value autonomous vehicles more than before the COVID-19 outbreak?[1,2]
Number of respondents, in percent



Despite regional differences, 33% of consumers value autonomous vehicles more due to the pandemic

1. Q: Based on your experience with COVID-19, do you value autonomous vehicles more than before the pandemic?
2. Aggregated results for US, UK, Germany, Italy, France, China and Japan

Source: McKinsey Covid-19 Consumer Survey, May 2020

10 timeless tests for AV strategy

Market	**1**	**Market development**	Do you have a clear perspective on future AV market size and profit pools?
	2	**One-time sales are outdated**	Do you have a clear vision how your business model and monetization model is changing due to autonomous driving?
	3	**Speed is king**	Do you have the right internal organization (e.g., agile development teams, own AV spin-off) to move fast in the industry?
	4	**Completely new customer and product segmentation**	Do you have a clear positioning/USP defined how to achieve the targeted market share with AV products or AV mobility services?
	5	**Cities are key**	Do you or your strategic partners have a team and strategy how to approach cities?
Control points	**6**	**Still huge challenges in AV technology**	Are you a leading player in terms of AV technology or have you secured access?
	7	**Integration capabilities**	Do you have capabilities or a partner for mass-market integration of AV technology into cars?
	8	**End customer game**	Do you or your strategic partner customer access that could be converted to an AV customer base?
Capabilities	**9**	**Totally different capabilities**	Have you created an attractive organization for external talent?
	10	**Network player will win**	Have you already found the best partner(s) to fill your white spots along the whole AV value chain?

Source: McKinsey Center for Future Mobility