

An aerial, top-down view of a city street grid. In the center, there is a large, circular park area with green lawns, walkways, and a central fountain. The surrounding city is densely packed with buildings and cars on the roads.

**strategy&**

Part of the PwC network

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# Digital Auto Report 2023

## What consumers really want

**VOLUME 1**

# Digital Auto Report 2023 – Volume 1



- ✓ Eleventh annual Digital Auto Report, developed by Strategy& and PwC
- ✓ Global consumer survey with a focus on the US, EU and China (n = 3,000)
- ✓ Quantitative market outlook up to 2035, based on regional structural analysis
- ✓ Interviews with industry executives at OEMs and suppliers, and with leading academics and industry analysts

## This report: Volume 1

### Understanding consumer preferences and implications

- Consumer view – changing mobility preferences
- Implications for auto players – interface, subscription and charging



## Coming up next: Volume 2

### Assessing global mobility market dynamics

- Market outlook – penetration of technologies and mobility types
- Technology – shifting gears in connected, electric, automated
- Regulation – slowdown or acceleration of key policies?



# Addressing changing consumer preferences requires auto players to gear up their user interfaces and business models

## Executive summary – Volume 1

### 1. Consumer preferences

- Our **consumer survey** (n = 3,000 in Germany, US, China) captures current **preferences in auto & mobility** and is contrasted with **expert opinions**
- In respect of **connected services**, consumers first want to **get the basics right** – the highest priority is **safety + navigation**, **phone mirroring** is gaining importance, **on-demand car functions** as well; experts rate the importance of **infotainment and lifestyle** higher than consumers do; **willingness to pay** for full set of connected services **stands at ~€20 / months in GER and the US, and at ~€40 in China** – experts give more conservative estimates
- **Germans still hesitant about BEV cars** – only **35%** would consider getting one; more openness in the **US ~50%**; **China very open to BEVs with >90%**
- **Low trust towards L4 automated vehicles** in **GER and US** with **60-70% feeling uncomfortable** vs. **15% in China**; but on the other hand, Germans who want to use L4 have a **higher willingness to pay to use robo-taxis than to use driver-driven taxis**; in the **US and China willingness to pay is lower**
- **Purchasing a new/used car preferred**; **subscription models gain traction**; **online car purchase scores highest in China** (36% vs.10% in Germany)
- Consumers intend to **use public transport more often than last year**, but show **similar intentions for own car**; **less interest in sharing / hailing**

### 2. Automotive implications

- **Auto players face strategic challenges** with regard to **connected, electric, automated & smart mobility**. Volume 1 focuses on **three key aspects**:
  - Getting the user interface right**

As **software-defined vehicles** open the door to many new markets, **OEMs** need to be clear in **which consumer life areas** they want to play, **which experience differentiators** to focus on (luxury vs. convenience), and how to build a **corresponding service portfolio**. **Investment** decisions should be based on **value creation beyond direct user revenues**, with a balanced view on **build vs. buddy vs. buy** for tech components
  - Rethinking vehicle sales**

OEMs benefit from a **rising demand for car subscriptions** - expected to grow from **0.3m to 2-4m units by 2035 in Europe**. To reach **profitability**, **OEMs need to balance consumer needs** (model flexibility, transparent pricing) with smart **asset lifecycle management** for maximum **residual value**
  - Going beyond the vehicle**

**New business models** emerge around **batteries and bi-directional charging**. With **~5m bi-di cars in Germany by 2035**, market potential is **€160-220m for vehicle-to-home / microgrid** and **€470-550m for vehicle-to-grid solutions** – assuming **successful orchestration of ecosystem players**

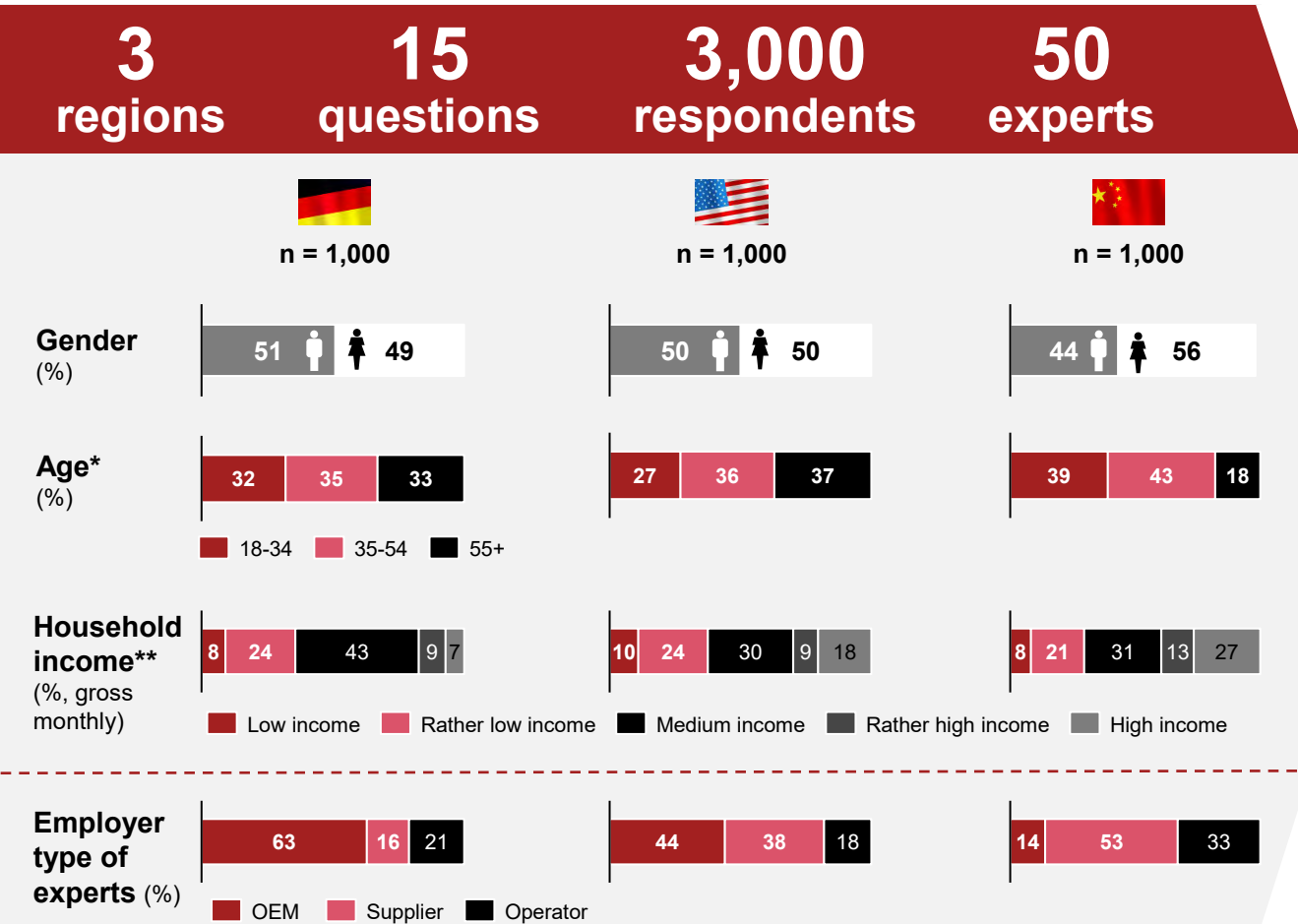


# Contents

1. Consumer preferences – connected, electric, automated and smart
2. Implications for auto players – interface, subscription and charging

# Latest consumer attitudes within CASE are reflected in a survey of 3,000 respondents in Germany, US and China

## Overview of consumer survey



## Key results



- **Safety + navigation remain the most important** connected services features – on-demand functions gaining popularity
- **Willingness to pay at ~20€ per month in Germany and the US, while at ~40€ in China** – experts more cautious



- **Germans still sceptical about BEV cars** – only 35% would consider getting one, but more openness in the US ~50%
- **In China, overwhelming preference for BEV** with >90% considering such option – vs. only 80% considering ICE



- **German / US respondents sceptical about L4 automated cars** – 60-70% uncomfortable vs. 15% in China
- **Willingness to pay for robo-taxis vs. driver-driven taxis is lower in the US and China than in Germany**

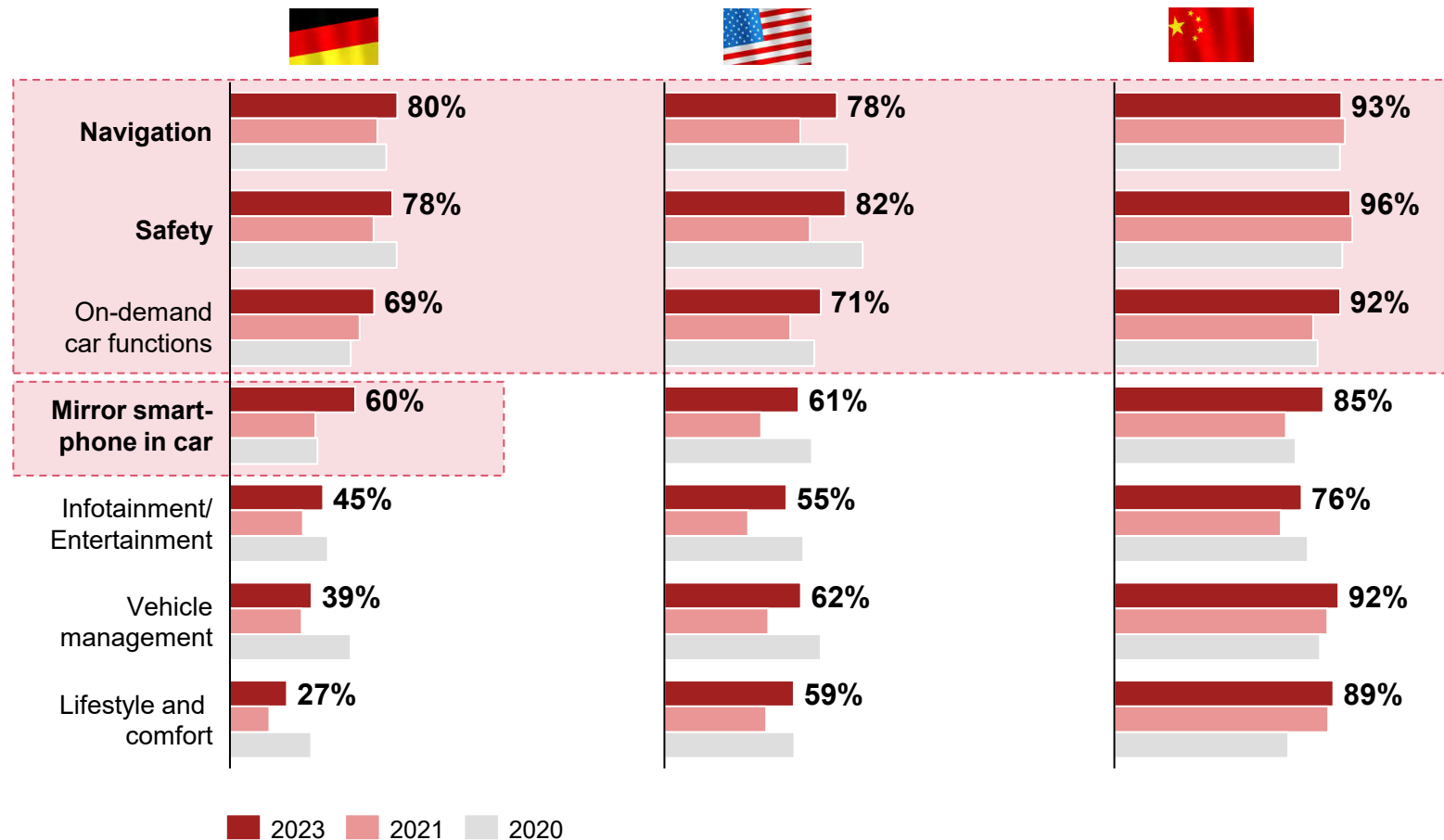


- **Purchasing a new or used car still preferred option, but car subscription models are gaining traction**
- **Consumers want to reduce CO<sub>2</sub> mainly through more walking/cycling, switching to electric car, and using more public transport**

# Safety and navigation remain as most important connected services features – on-demand car functions on the rise



## Connected services – Share of participants rating feature as important



**Question:** “Which connected service categories are particularly important to you?”



**Safety and navigation** still most important feature for respondents across all regions.

**Significant increase** in the number of participants in Germany who rate **smartphone mirroring as important**”

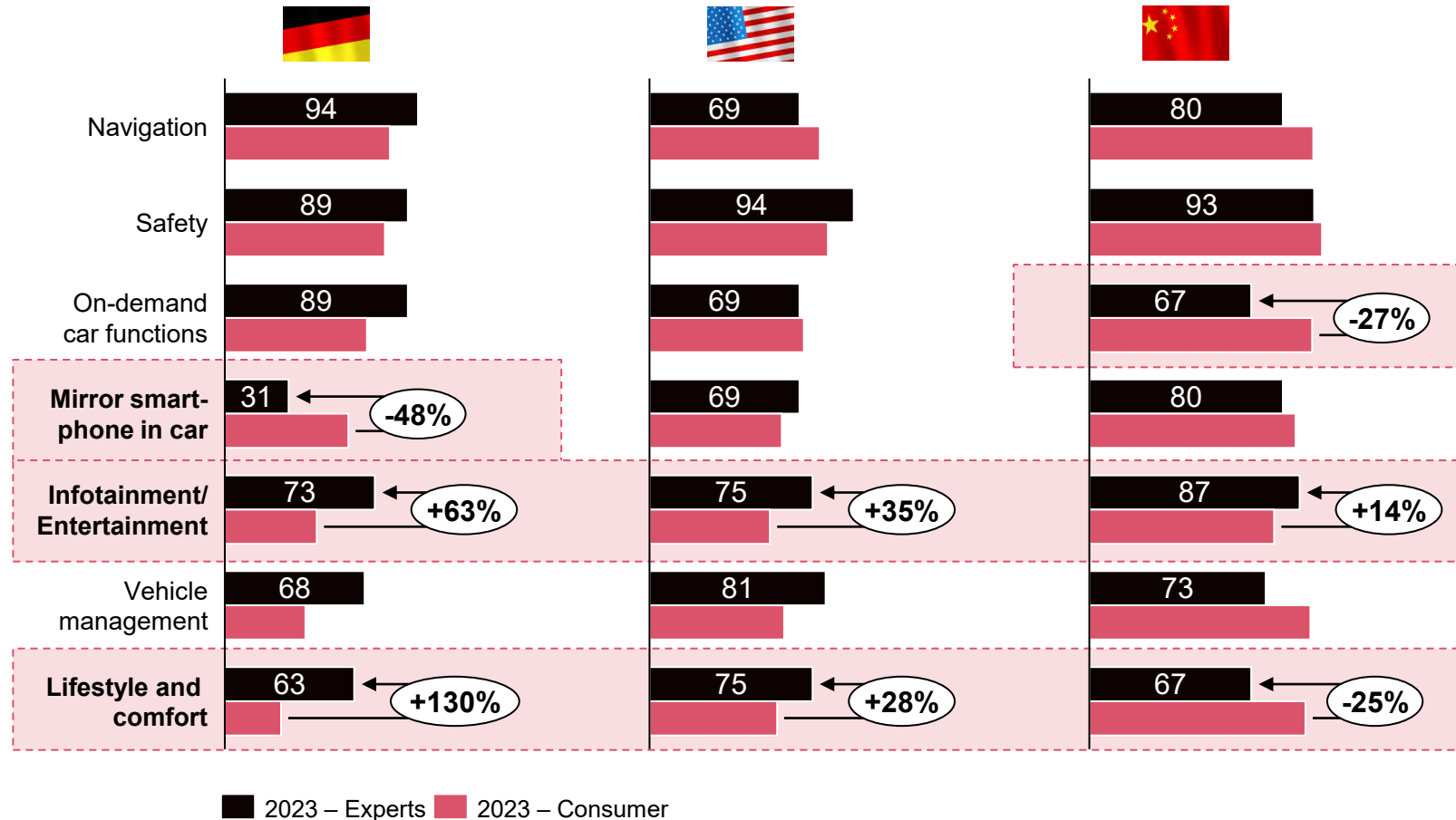


Infotainment/entertainment more important for younger consumers

# Experts rate infotainment higher than consumers do –in China, they underestimate relevance of on-demand functions



## Connected services – Share of experts rating feature as important



**Question:** “Which connected service categories are particularly important to you?”



Safety, navigation and entertainment are considered the **most important** by experts.

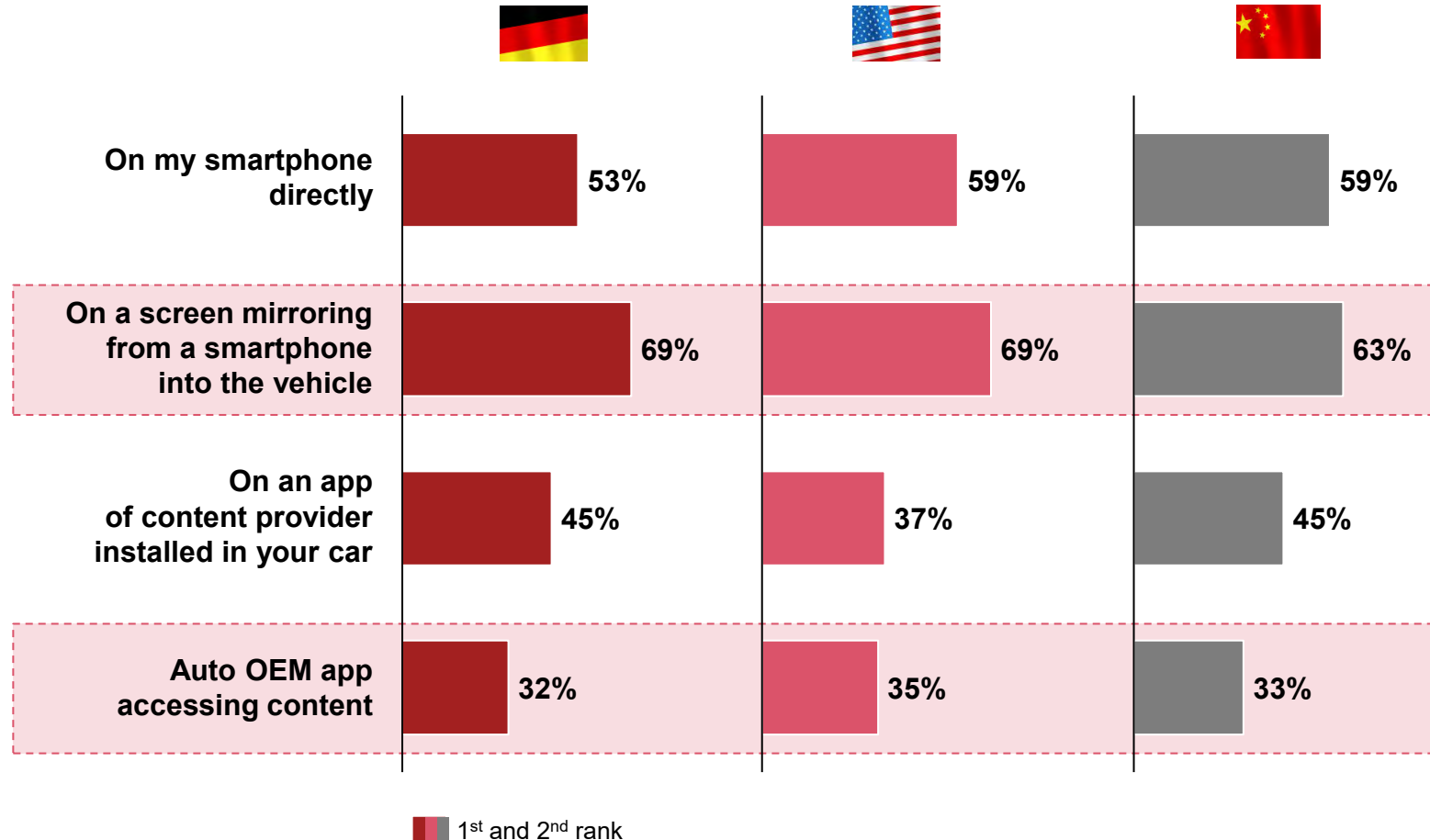
Experts in **Germany** are rather **less enthusiastic** when assessing the importance of **mirroring smart-phones**

Experts in **China** are comparatively less upbeat when assessing the importance of **on-demand functions** and **lifestyle & comfort services.**”

# Smartphone mirroring to the car has highest rating; Auto OEM apps for service access are less popular



## Connected services and media/entertainment in the car



**Question:** “How would you prefer to enjoy connected services and media/entertainment in your car?”



” Highest **preference** across all countries is for smartphone **mirroring**.  
Media/entertainment via an **auto OEM application** is **less popular**.”



# Willingness to pay for connected services around 20€/month in Germany and the US but twice as much in China (40€)

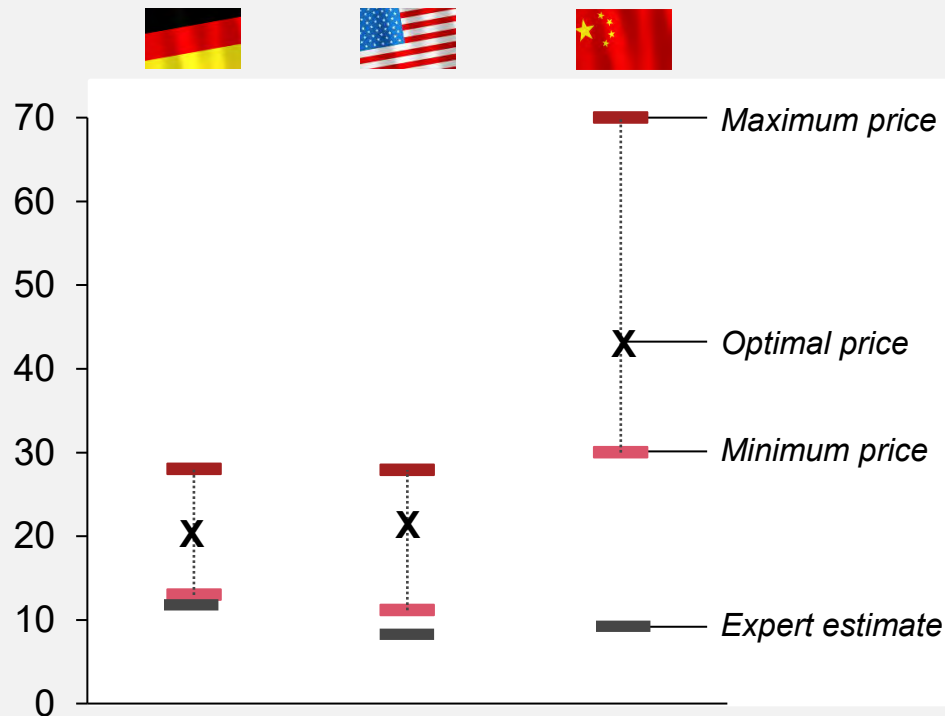
## Connected services – Median willingness to pay<sup>1)</sup>



### Willingness to pay<sup>1)</sup> (monthly in €)

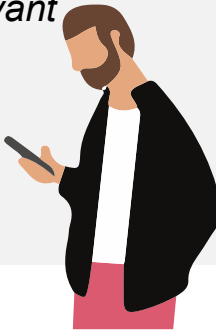
...for a full set of connected services in the vehicle that “perfectly fit your needs”

#### By nationality



**Question:** “At what price would you consider a full set of relevant connected services

- Too cheap?”
- A good value for money?”
- Starting to get expensive?”
- Too expensive?”



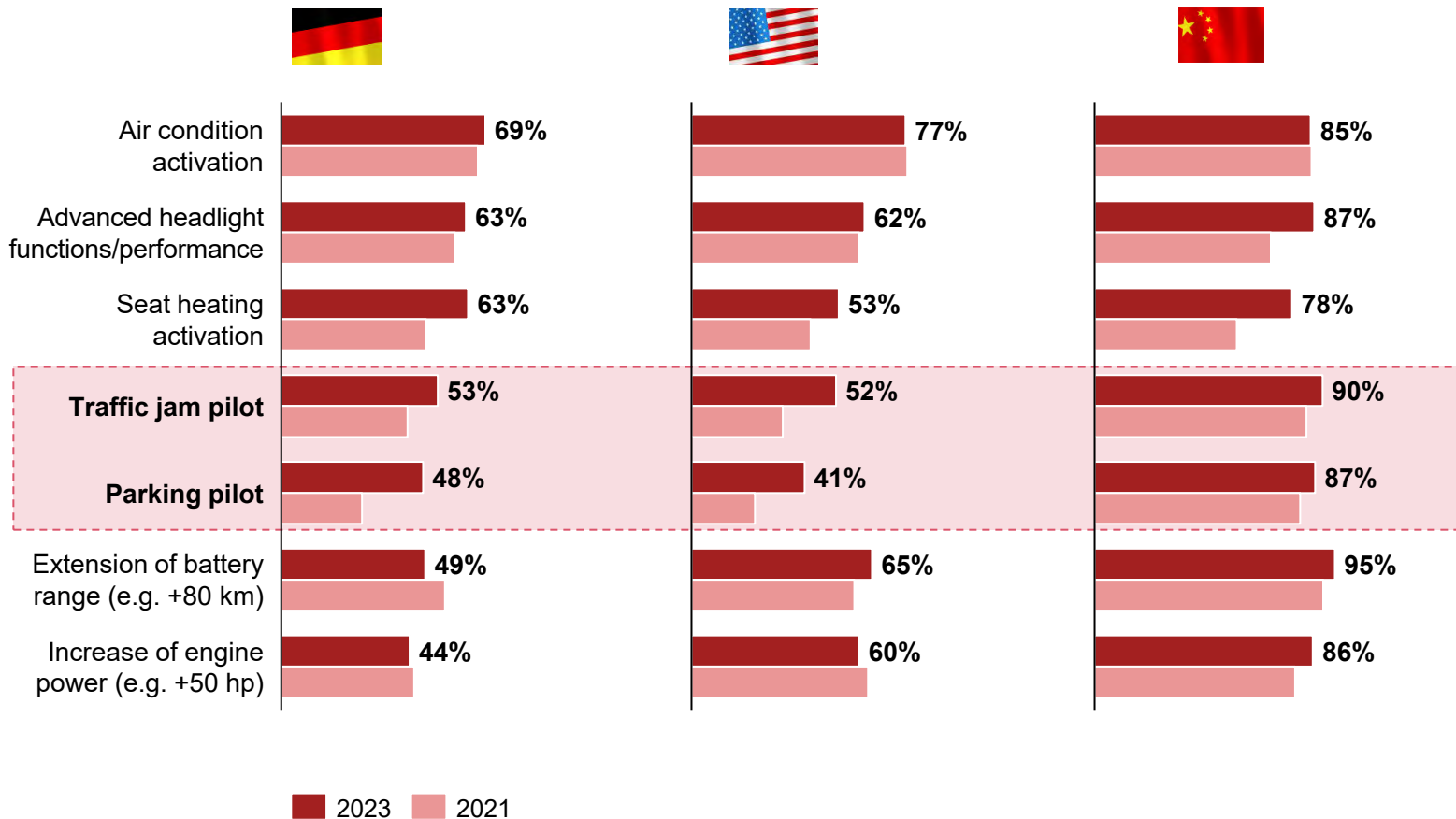
”

**High spread** of willingness to pay in China indicates **strong polarisation of luxury vs. budget customers** → differentiated service packaging needed

**Higher optimal price in China** indicates that **consumers envision more benefits** from the “perfect connected service bundle” than in the US/GER – **expert view more conservative on prices.**”

# Among on-demand functions, automated driving features such as traffic jam pilot / parking pilot are attracting more interest

## On-demand car functions – Share of participants rating function as important



**Question:** “How important would be on-demand car function [...] to you?”



”

**Automated driving functions** – traffic jam pilot or parking pilot – attract considerably more interest vs. previous year.

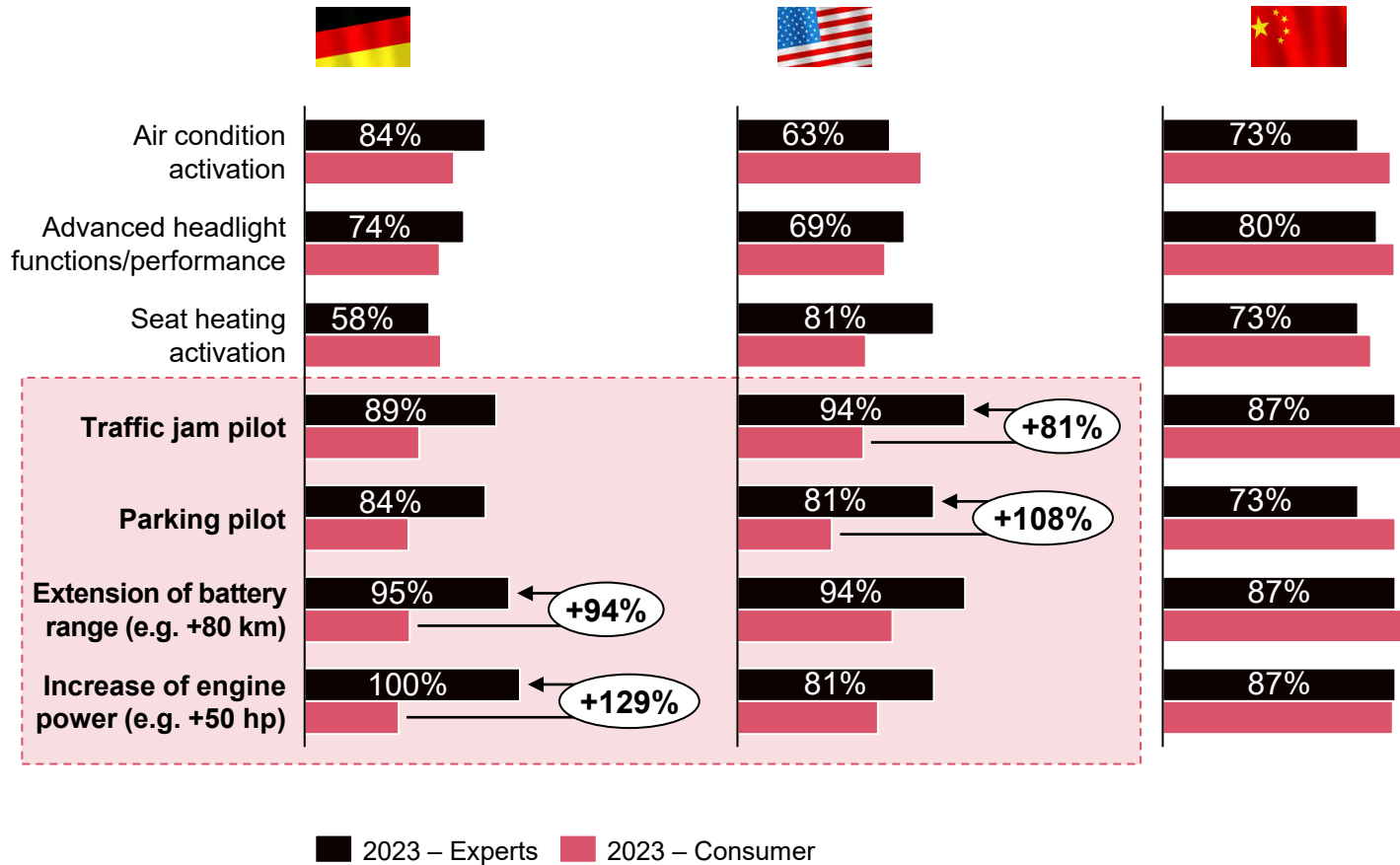
**Air condition activation** is still viewed as the most important on-demand car function.”

+ Traffic jam pilot more important for older consumers

# Experts in Germany / US attach even more importance than consumers to automated driving function attractiveness



## On-demand car functions – Share of experts rating function as important



**Question:** “How important would be on-demand car function [...] to you?”



”

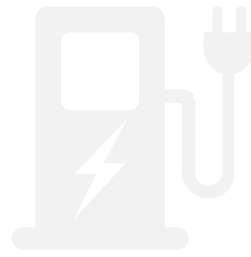
**Extension of battery range and traffic jam pilot are considered the most important functions among experts**

When compared with consumers, experts are particularly bullish about on-demand **engine power.**”

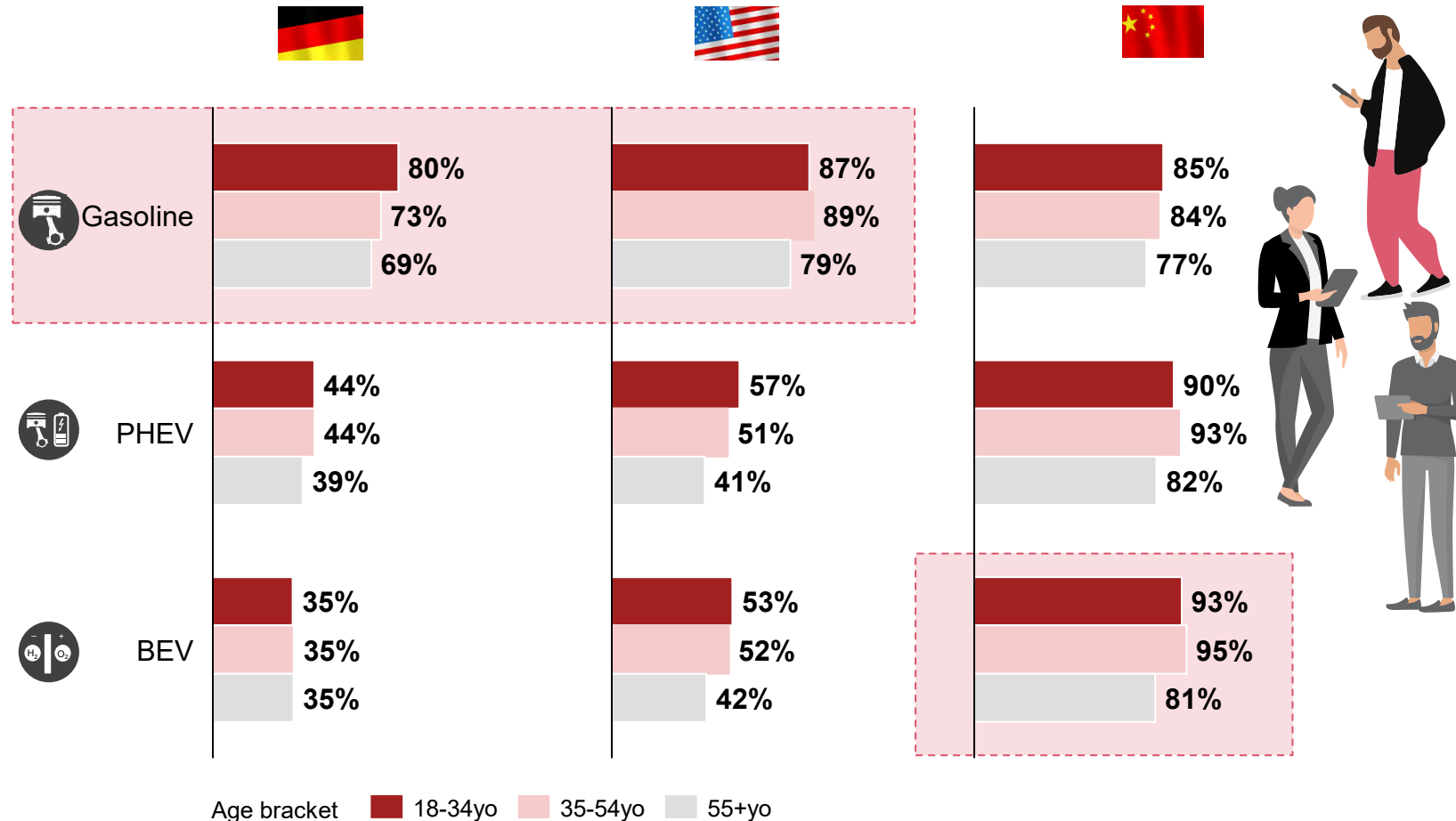


Experts in US & China are more conservative in assessing the importance of air conditioning activation

# Looking at powertrain preferences, German and US consumers stick with gasoline, while Chinese prefer BEV



## Share of participants rating engine types as likely for next purchase (%)



*Question: "Assuming you wanted to buy/lease/subscribe to a passenger car, how likely are you to consider the following types of engines?"*

“**Gasoline is most popular engine type in USA and Germany**, followed by PHEV engines, which are slightly more popular than BEVs.

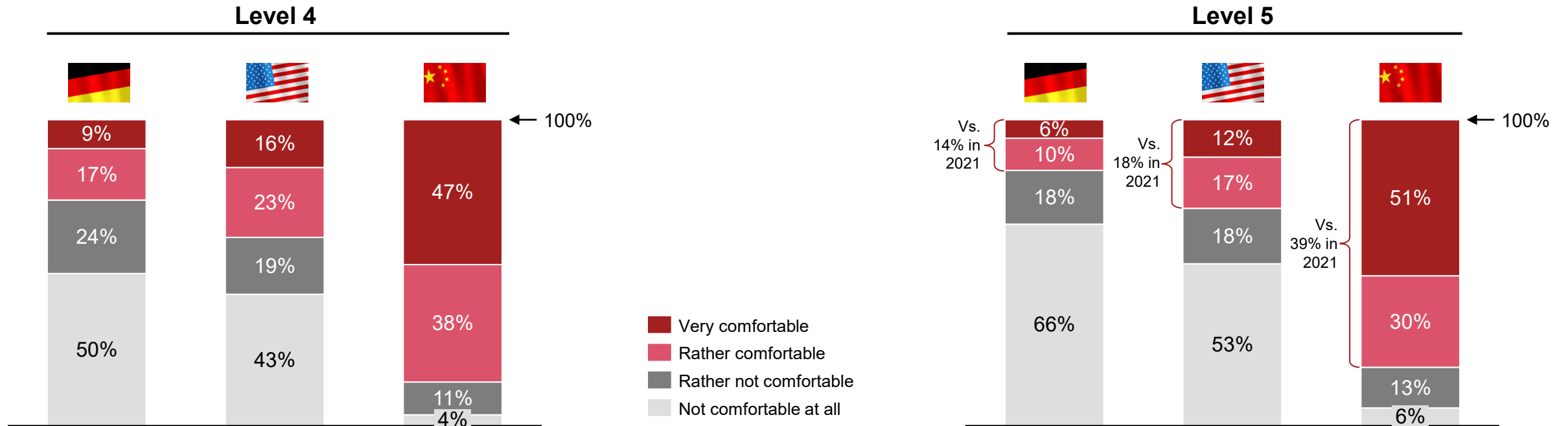
**Chinese consumers** exhibit opposite preferences with **BEVs being most popular**, ahead of hybrid and ICE engines.”

+ Gasoline engine surprisingly more attractive for younger consumers

# Consumer acceptance of automated driving remains low in Germany and the US – more openness in China



## Automated driving – Consumer attitudes



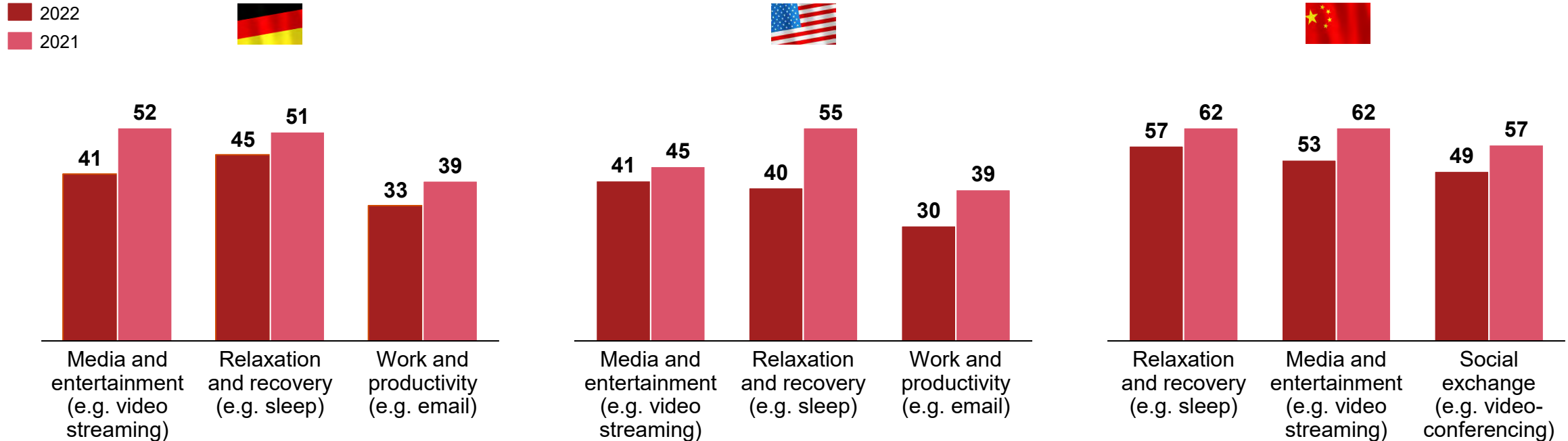
**Question:** “How comfortable would you feel using an autonomous vehicle (Level 4<sup>1</sup>)?”

” In general, willingness to use automated cars has recovered in comparison with relatively low 2020 figures, which resulted from negative headlines at the time e.g. following accidents and cybersecurity threats. Scepticism towards “fully automated” vehicles (Level 5) still stronger than for Level 4.

**Question:** “How comfortable would you feel using a fully autonomous vehicle (Level 5<sup>2</sup>)?”

On an robo-ride, people want to be entertained or relax – in GER / US they also want to work, but in China prefer to socialize

### Automated driving – Top 3 preferences for usage of time gained



**Question:** “For which activities would you use the time gained while driving in a fully autonomous vehicle?”

” The intention to use time gained from not driving went down compared to 2021 – the reduction was significant in Germany and the US. Media & Entertainment as well as relaxation are still the main intended activities.”

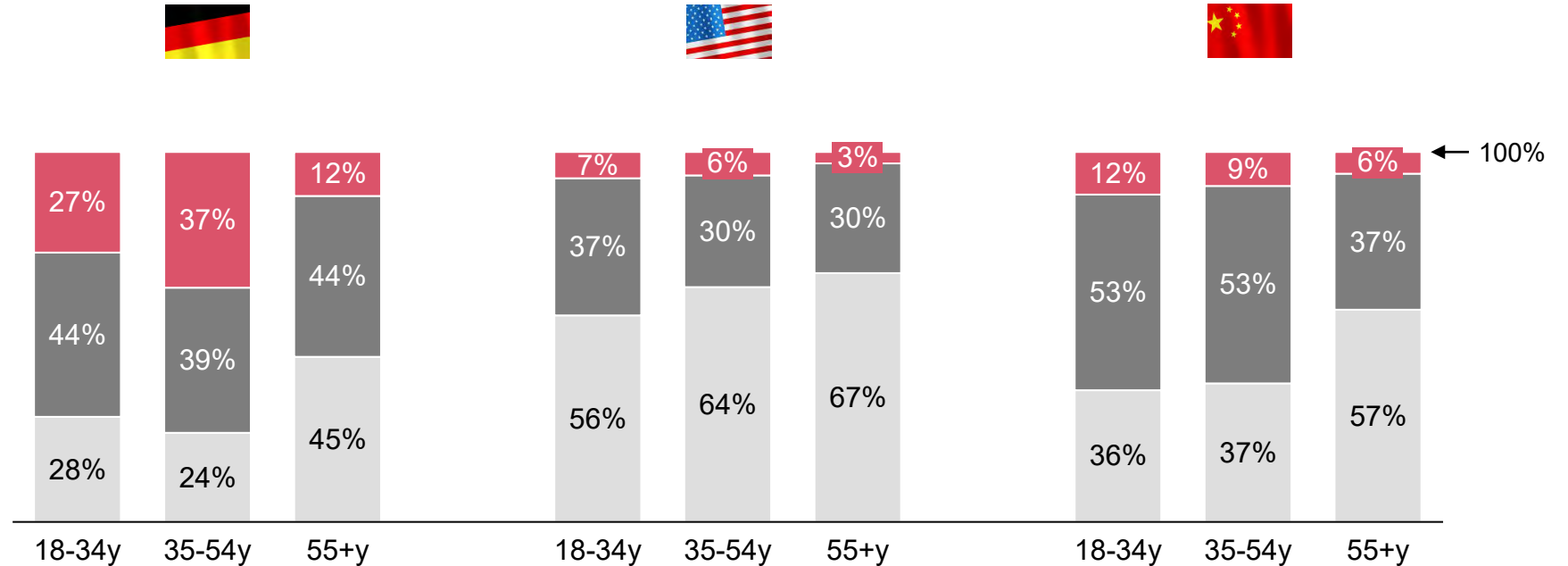
~60% of US citizens want to pay less for a robo-taxi vs. a driver-driven taxi; only ~5% want to pay more vs. ~30% in Germany

### Automated driving – Willingness to pay

**Question:** “When considering an average taxi ride and its price, what would be your willingness to pay for an autonomous ride compared to this taxi ride?”

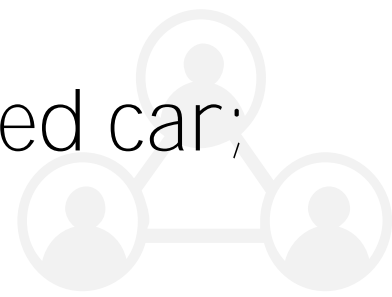


- I'm willing to pay more
- I'm willing to pay the same
- I'm willing to pay less

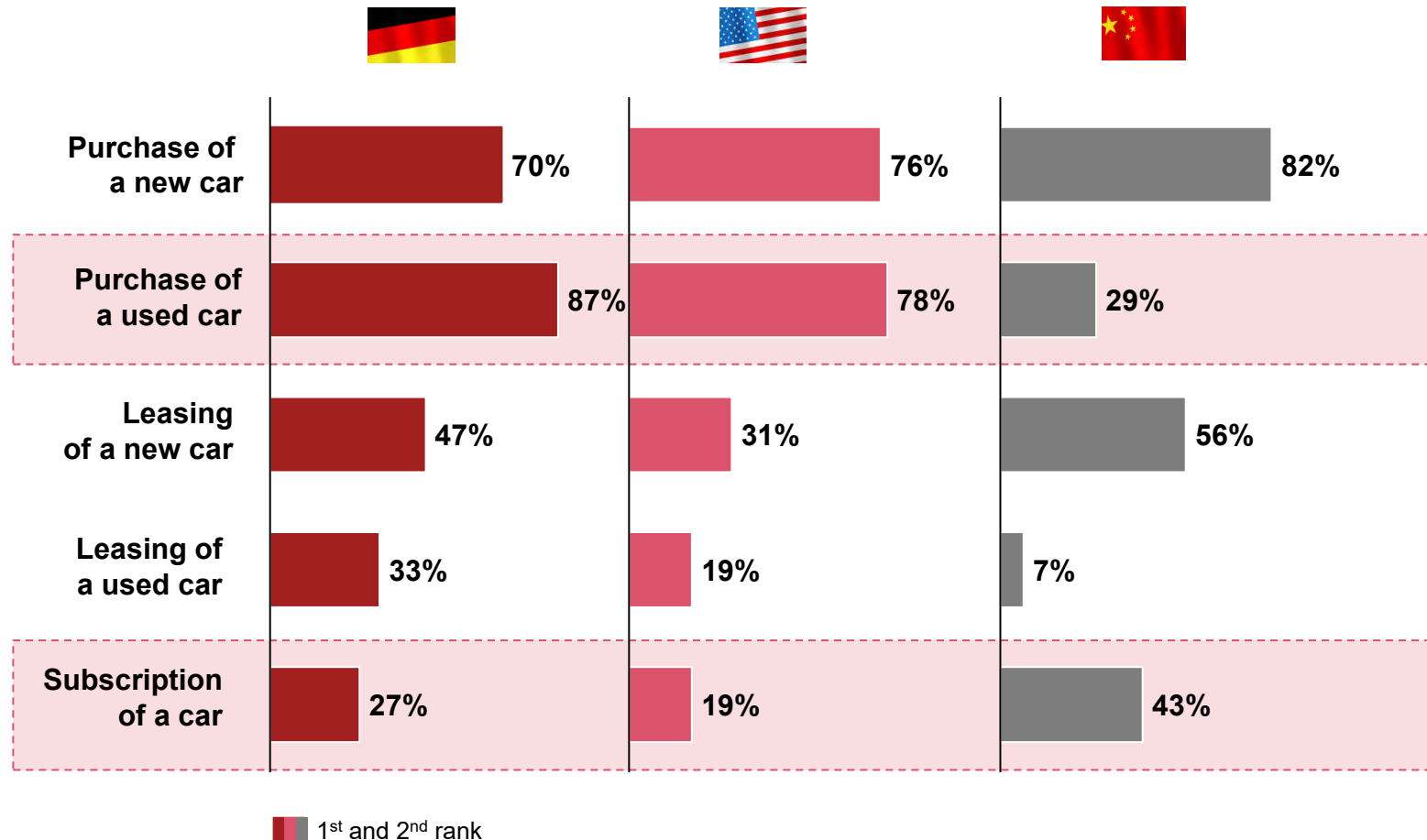


“While younger German respondents are willing to pay more for an autonomous ride, older Germans are less inclined to do so. US and Chinese respondents overwhelmingly intend to pay less for an automated ride – among those who want to pay less, a 40-50% price cut from driver-driven taxis is the norm.”

# Majority of respondents prefer to purchase a new or used car; but car subscription models are attracting interest



## Ranking of buying/leasing/subscribing to a car



**Question:** “How would you rank the following ways of acquiring a car if you needed to purchase, lease, or subscribe to a passenger car in the next one to two years?”



”

The **intention to purchase a used car is growing**, especially in Germany and the US.

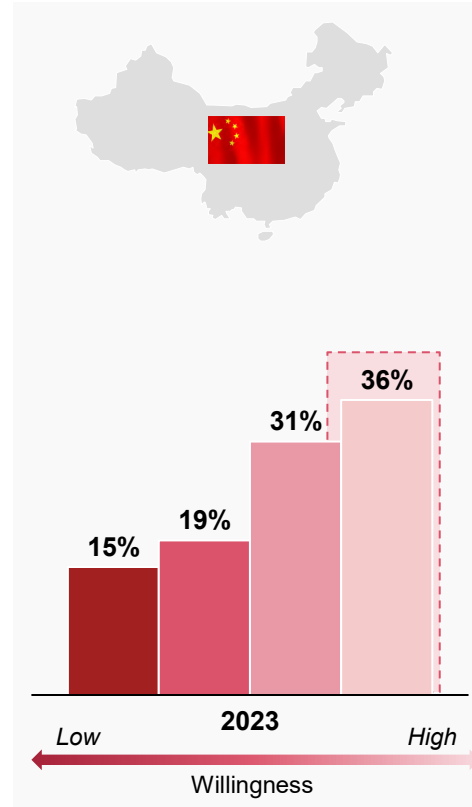
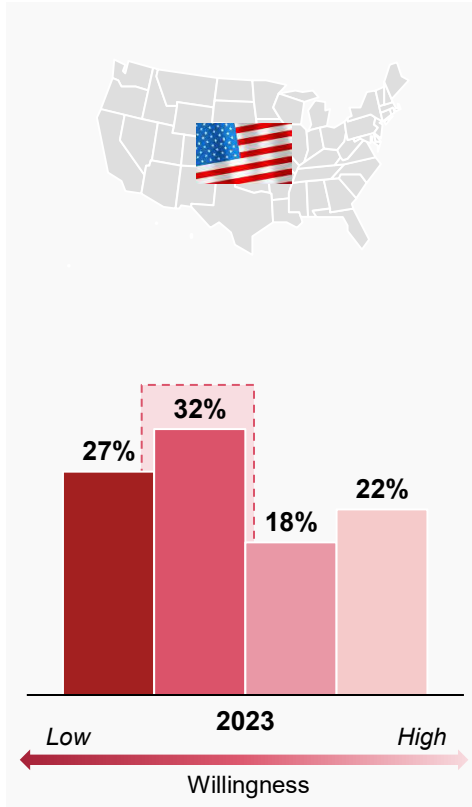
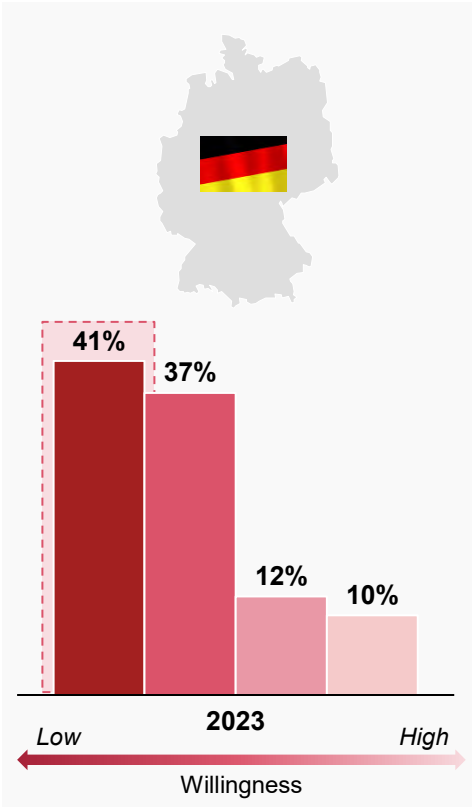
**Subscription is gaining in popularity** – especially in China. The preference for subscription increased strongly in Germany and the US in 2023 (27% vs. 14% in Germany and 19% vs. 15% in US).”



# Readiness for online car purchases very high in China, while rather low in Germany – the US falls in between



## Willingness to make car purchases online



- I would rather do everything at the store
- I would configure it online, but sign and test drive it at the store
- Yes, I feel comfortable configuring and signing online, but I would prefer to do a test drive at the store
- Yes, I feel comfortable with doing all steps online

**Question:** “Would you buy your next car online?”



”

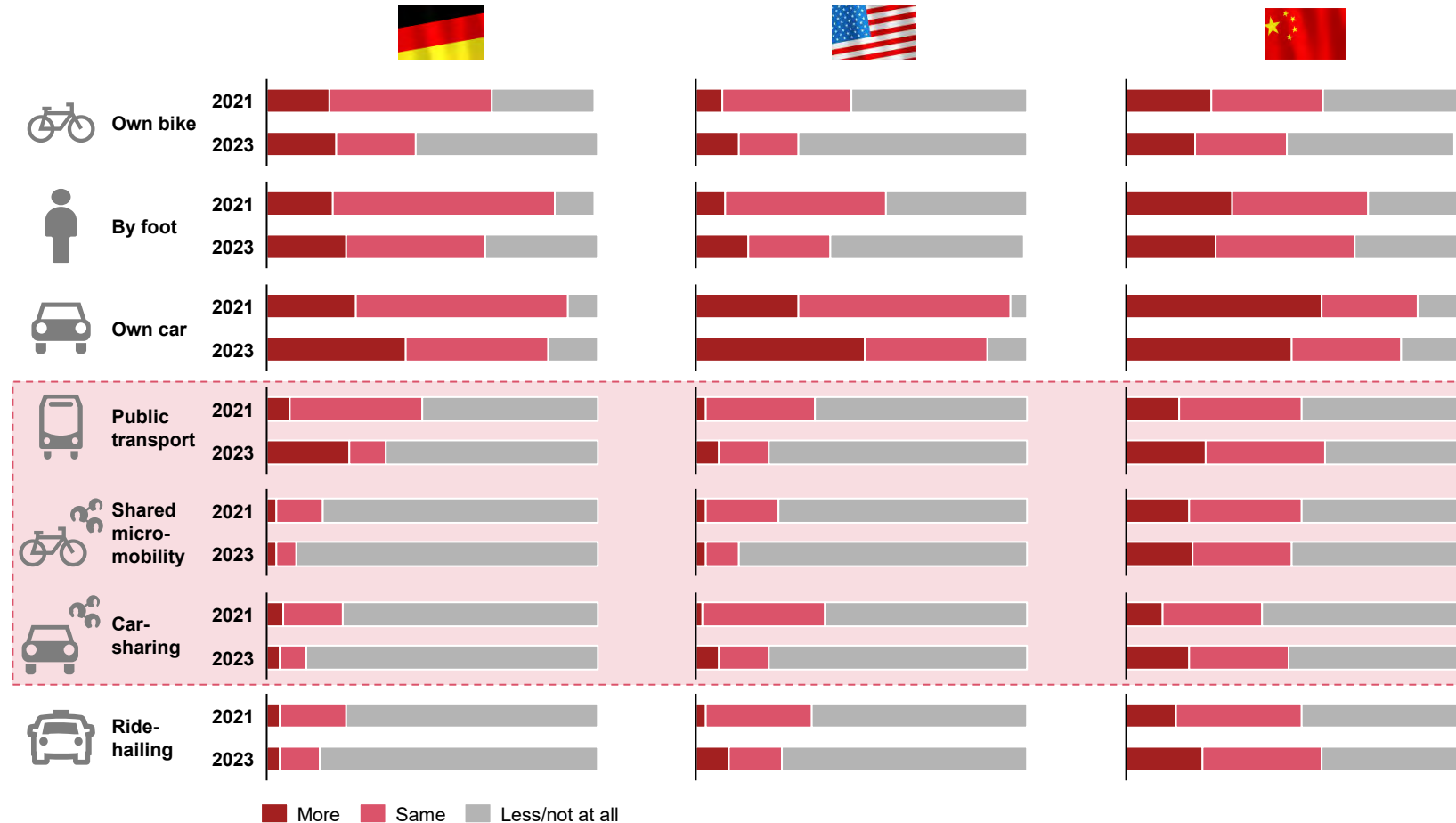
The willingness to **buy a car online varies significantly across countries.**

**In China**, people are **particularly open** to completing certain steps or even the entire buying process online.

In contrast, the majority **in Germany** feel **more comfortable** with store processes.”

# Even as immediate COVID-19 risks decline, using one's own car remains popular; increasing use of shared modes in China

## Mobility pattern after COVID-19 restrictions (%)



**Question:** “COVID-19 has temporarily changed our mobility behavior in many aspects. How do you plan to use modes [...] of transport once we have left the pandemic behind us?”

”  
**Using one's own car is still seen as the most convenient means of transportation – with highest increase in demand in Germany and the US.**

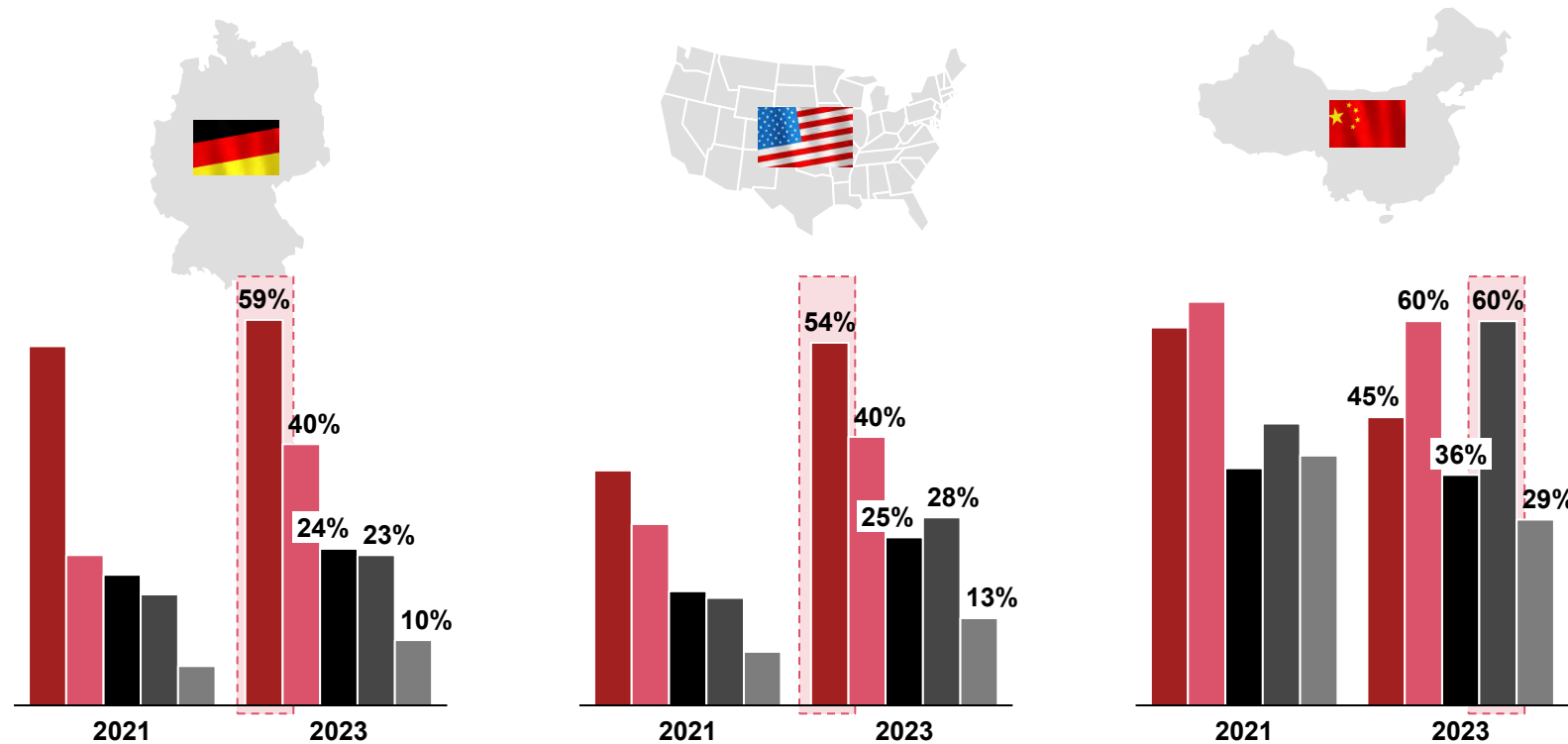
**In China, consumers plan to use shared modes more.**

**Across all regions, the number of people planning to use public transport more has increased.”**

# Price and availability are by far the top drivers for encouraging consumers to use sustainable transport



## Factors encouraging sustainable transportation modes

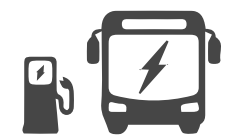


- Cheaper price
- Better availability (e.g. more bikes)
- Incentives by the employer (e.g. job bike, car sharing benefit package, ...)
- User-friendly access (e.g. cashless payment via app, ...)
- Family offers (e.g. 4 bikes for the price of 2, ...)

**Question:** “What would encourage you to use sustainable transportation (e.g. bike sharing, car sharing, public transportation) more frequently?”

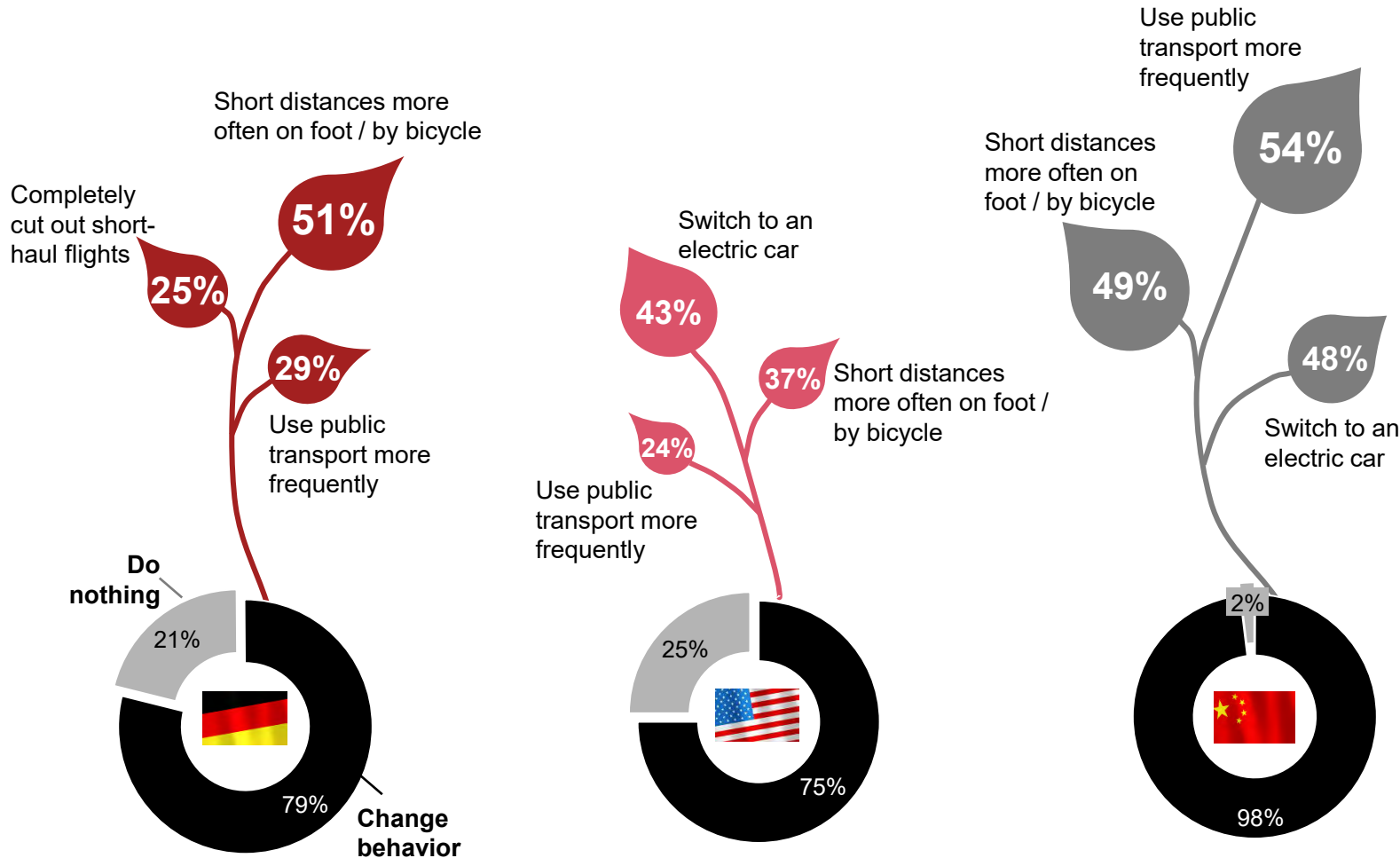
” In **Germany**, there has been a sharp increase in the number of consumers who say that **better availability** is an important factor in persuading them to use sustainable transport.

**US respondents** focus strongly on **cheaper prices**, whereas **user-friendly access** is most likely to encourage respondents to use sustainable transport in **China**.”



# Every country has different priorities to reduce CO2: In GER more walking, in the US switch to BEV, in CN public transport

## Top-3 contributions to CO<sub>2</sub> reduction



**Question:** “What major personal changes would you like to do to contribute to a reduction in CO<sub>2</sub> emissions?”

”  
**High willingness to contribute to CO<sub>2</sub> reduction, especially in China (98%) – strong increase in the US (79% vs. 52% last year)**

Main contributions will be completing **short-distance journeys** more often on foot / by bicycle, switching to an electric car, or using public transport more frequently.”

# Contents



1. Consumer preferences – connected, electric, automated and smart
2. Implications for auto players – interface, subscription and charging



*Getting the user interface right*

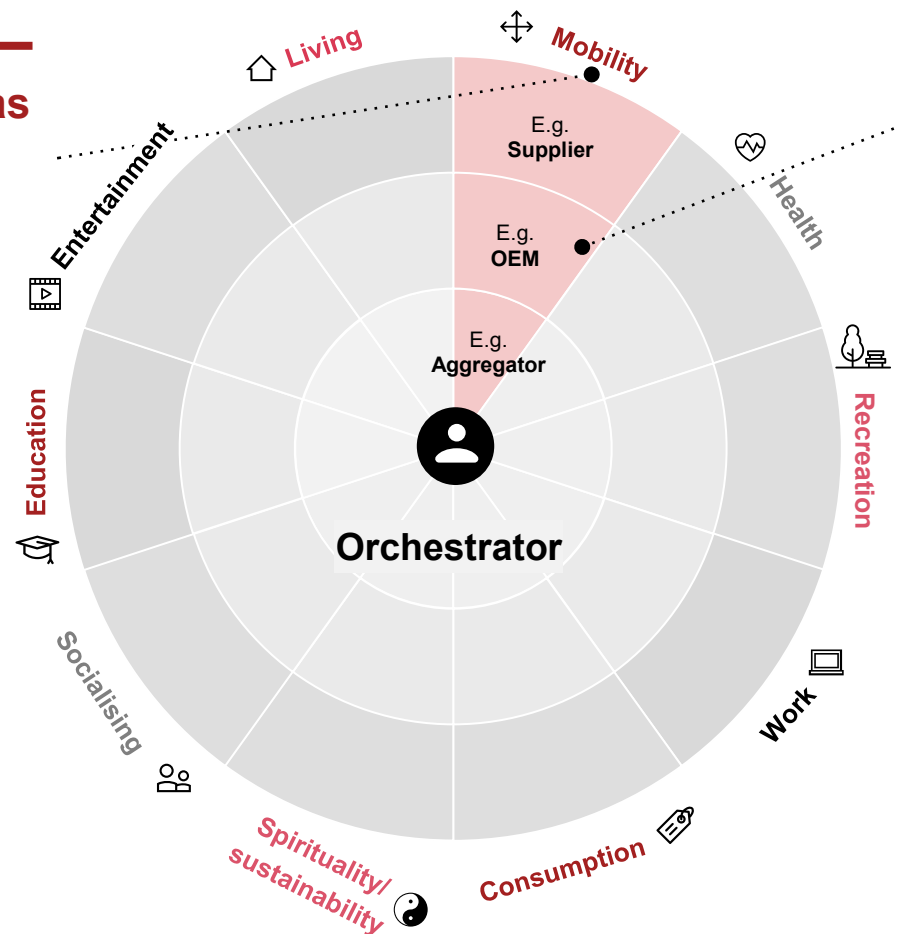
# The relevant market for automotive players is expanding beyond the car itself – maintaining user access is crucial

## Redefining business models to meet human-centric mobility needs

### Mobility demand

Human needs in **mobility Life Areas** determine customer requirements

- **Mobility demand** is influenced by long-term economic, political and social trends as well as generational changes
- The individual user is located at the center of the ecosystem approach (**business to human**)
- Consumer needs can be grouped into ten distinct **Life Areas**
- Within these Life Areas, **ecosystems** emerge in the form of business-to-business and business-to-consumer relationships around specific customer needs



### Mobility solutions

Successful **mobility ecosystem players** are clear on four key topics:

 **Experience differentiators**

E.g. luxury, convenience, ...

 **Digital portfolio scope**

E.g. life area coverage, niche positioning, ...

 **Value levers**

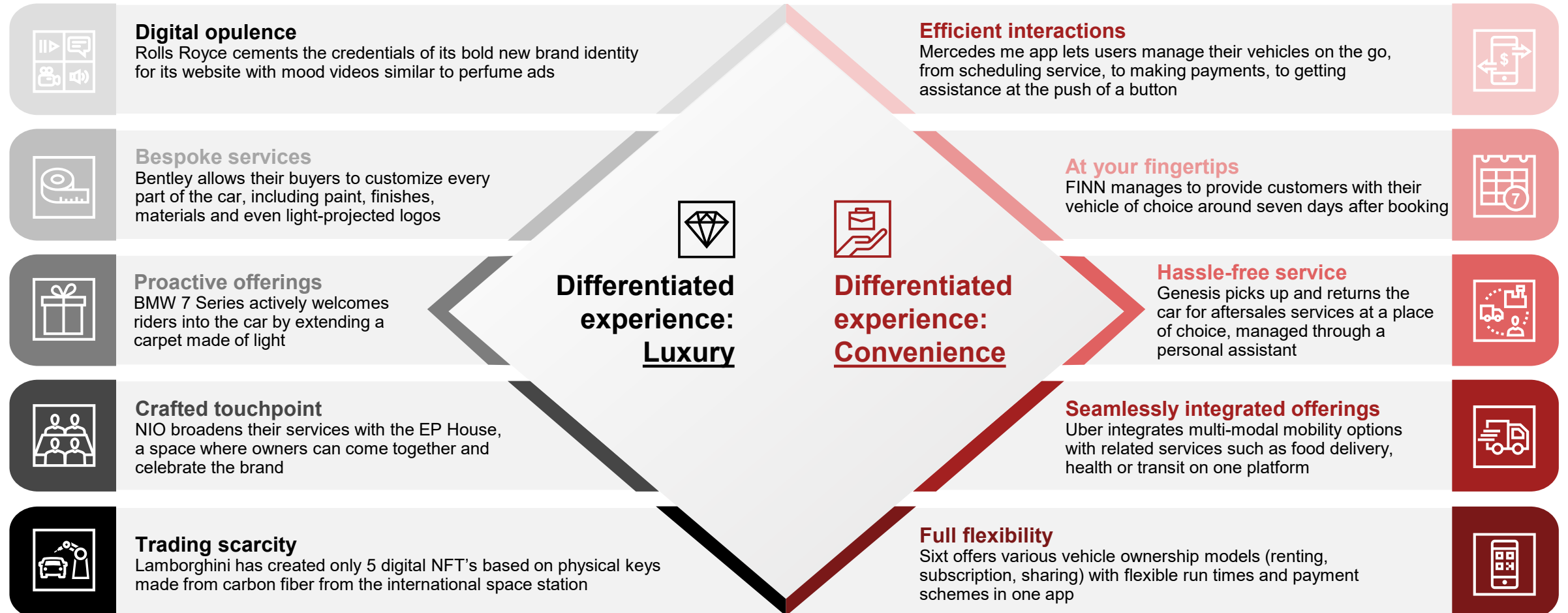
E.g. top-line, bottom-line optimization, ...

 **Value chain integration**

E.g. vertical/horizontal integration, partnering, ...

# Getting the digital interface right means creating a differentiated experience for diverse customer needs





## Experience differentiators – Examples





# A value-creating digital service portfolio requires automotive players to balance multiple trade-offs

## Digital portfolio scope – Examples

	Mobility	Entertainment	Work	Health	Portfolio Trade-offs
 <b>Vehicle Function -as-a-Service</b>	<b>Access</b> – Tesla virtual bluetooth keys <b>Light</b> – BMW high beam assist <b>Camera</b> – Tesla sentry mode	<b>Sound</b> – BMW e-engine sound pack <b>Intelligent car assistant</b> – Alibaba, Volvo/Daimler <b>AI Avatar</b> – Fetch.ai autonomous agents			» <b>Differentiation vs. revenue potential</b>
 <b>Consumer onboard services</b>	<b>Autonomous driving</b> – Tesla autopilot upgrade <b>Advanced navigation</b> – MB live traffic	<b>Gaming</b> – Tesla arcade, Racing <b>Entertainment</b> – Tesla karaoke <b>Music streaming</b> – BMW Spotify, NIO Radio <b>In-car AR gaming</b> – Audi/holoride partnership	<b>Crypto Car Wallet</b> – Various pilots	<b>Passenger safety</b> – NIO fatigue warning <b>Mood-based lightening</b> – Mercedes-Benz ambient <b>Meditation</b> – Porsche Feel-Good-Coach	» <b>Reach vs. profitability</b>
 <b>Consumer offboard services</b>	<b>Parking search and pay</b> – VW we park <b>P2P car/ride sharing</b> – Sono motors app <b>Plug and charge</b> – VW/Ionity <b>Automated park and charge</b> – Bosch Autom. Valet Parking	<b>NFT Collections</b> – Roll Royce Phantom <b>Web3 Loyalty Program</b> – BMW/Coinweb	<b>In-car Office</b> – Mercedes me connect <b>Smart Office Connection</b> – BMW IFTTT	<b>Emergency assistant</b> – GM OnStar guardian	» <b>Synergy focus vs. risk hedging</b>
 <b>B2B/data services</b>	<b>Predictive maintenance</b> – BOSCH, Carmen <b>Car data based insurance</b> – BMW CarData <b>Car data marketplace</b> – Caruso, Otonomo, High M.		<b>Fleet mgmt./diagnostics</b> – Daimler connect business <b>Driver's log/GPS tracking</b> – Daimler connect business <b>Last Mile Logistics</b> – NIO delivery in trunk	<b>Roadside assistant support</b> – Urgently/Otonomo <b>Safer traffic planning</b> – Mercedes Data/London	» <b>Touchpoint control vs. open partners</b>
					» <b>Digital first vs. BEV/AD availability</b>

# Along the value chain and vehicle life cycle, digital services unlock value beyond direct user monetization

## Value levers of digital services – Examples

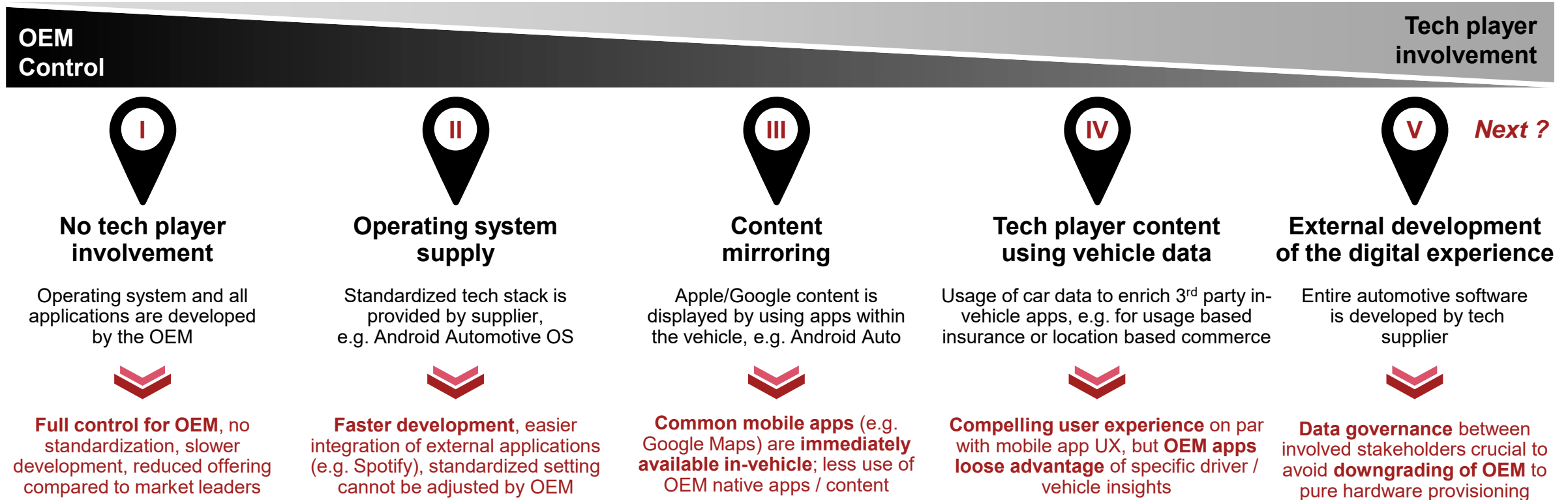
<b>Top-line: Direct revenue and customer lifetime value</b>	<b>Services monetization</b>	Connected services activation fees and/or recurring revenues related to monthly subscriptions	<b>60-70%</b> are willing to pay 180\$/year for connectivity service set
	<b>Post-purchase activations</b>	Upselling effect during the ownership cycle by unlocking personalization features or activating built-in hardware	<b>35-50%</b> are interested in post-purchase activations
	<b>Brand loyalty</b>	Higher satisfaction with on-board experience and creation of 'stickiness' through subscription services	<b>45-55%</b> are more loyal to brands to which they have a subscription
	<b>After-sales Loyalty</b>	Higher revenues for dealers from original parts sale and workshops traffic triggered by predictive maintenance	<b>30-40%</b> switch to paid subscription after free trial
	<b>Platform access/ data sales</b>	Direct revenues from granting third parties access to own platform or monetizing (anonymized) data/insights	<b>50-60%</b> of companies indicate that they do sell data to third parties
<b>Bottom-line: OpEx/CapEx Optimization</b>	<b>R&amp;D optimization</b>	Leverage of real time data on customer preferences/behaviors for timely adjustment of vehicle specifications and features	<b>30-40%</b> additional revenue potential based on customer insights
	<b>Variant management</b>	Reduction of the number of model-specific variants by activating on-demand vehicle features	<b>20-30%</b> cost reduction potential through variant reduction
	<b>Parts inventory management</b>	Optimized inventory management through advanced planning of upcoming repairs enabled by predictive maintenance	<b>20-30%</b> inventory decrease due to demand forecasting
	<b>Recall campaigns</b>	Prevention of recall campaigns by leveraging OTA updates to fix potential technical issues within the circulating fleet	<b>30-40%</b> of incidents can partly/fully be prevented by OTA

## Implications

- Ecosystem business cases should extend **beyond vehicle-centric** business cases
- **Direct and indirect revenue** potential, and **opportunities beyond vehicle offerings**, should be considered along the customer life cycle
- **B2B offerings** offer significant **direct monetization potential**
- In addition to external opportunities, a significant amount of **internal opportunities** exist, e.g. to increase efficiency in processes & portfolio

# OEMs are forced to partner with technology players to deliver compelling digital services – risking a loss of control

## Value chain integration – Range of partnership options





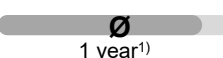


**A winning digital experience requires customer proximity, tech capabilities and effective data governance**



*Rethinking vehicle sales*

# Subscription fills the gap between leasing and rental offerings – resulting overall in four major vehicle ownership archetypes

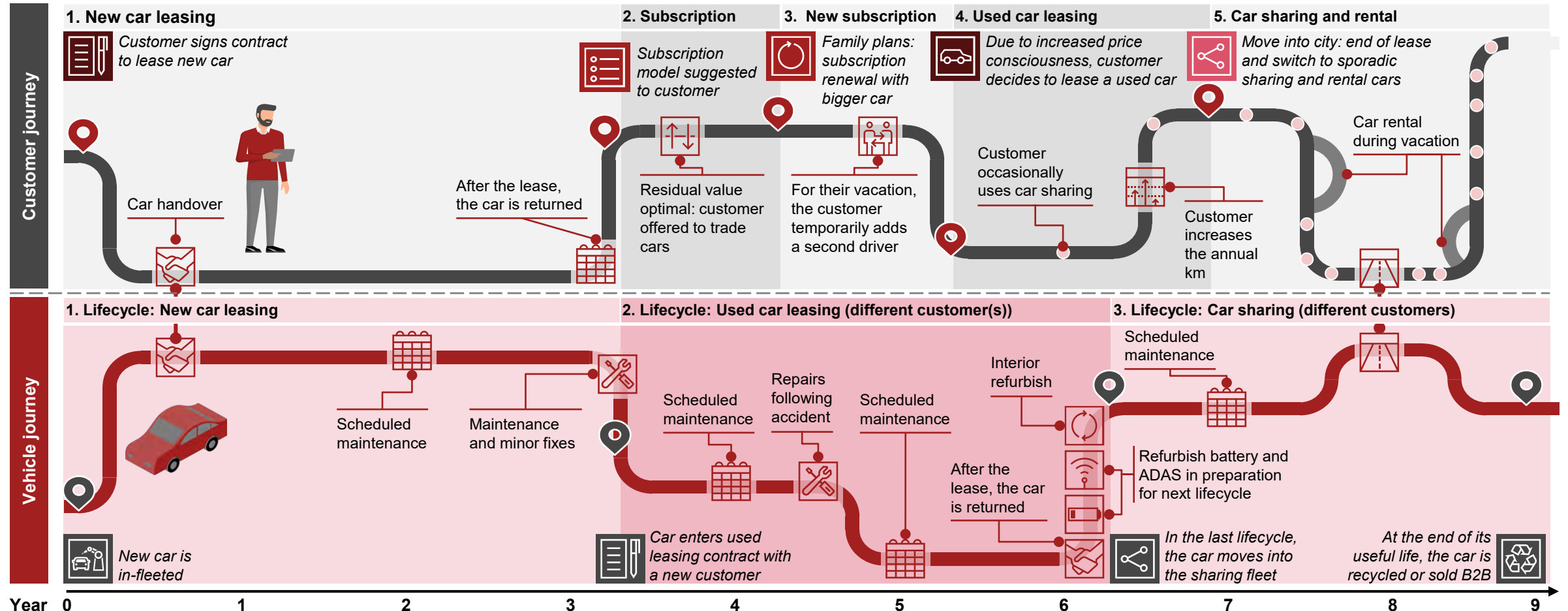
## Vehicle ownership archetypes

	 <b>Leasing</b>	 <b>Subscription</b>	 <b>Rental</b>	 <b>Sharing</b>	
<b>Relative price per month</b>	Low, due to fewer services and longer duration	High, due to high convenience	High, due to high amount of included mileage	Highest, due to highest convenience and most services included	
 <b>Included services</b>	Exact model selection/some configuration	✓	~	✗	✓
	Up-front down payment	✓		✗	
	Risk-dependent fee (driver history)	✓	✗		~
	Insurance, tax and registration	✗		✓	
	Scheduled service, repairs/wear and tear	✗		✓	
	Additional driver allowed	~	✓		~
	Flexible cancellation	✗		~	✓
	Switching models	✗	~		✓
	Delivery and collection	✗	✓	~	✓
	Residual value coverage	✗		✓	
Fully digitized customer journey	✗		✓		
<b>Duration (average figures for Germany)</b>	2 years  trend ← 3 years <sup>1)</sup> → 5-9 years <sup>2)</sup>	1 month  1 year <sup>1)</sup> → 2-6 years	1 day  7 days <sup>1)</sup> → 1 year	10 min.  trend → 30 min <sup>1)</sup> → 1 week	

✓ / ~ / ✗ = Usually included / Depends on provider / Usually not included

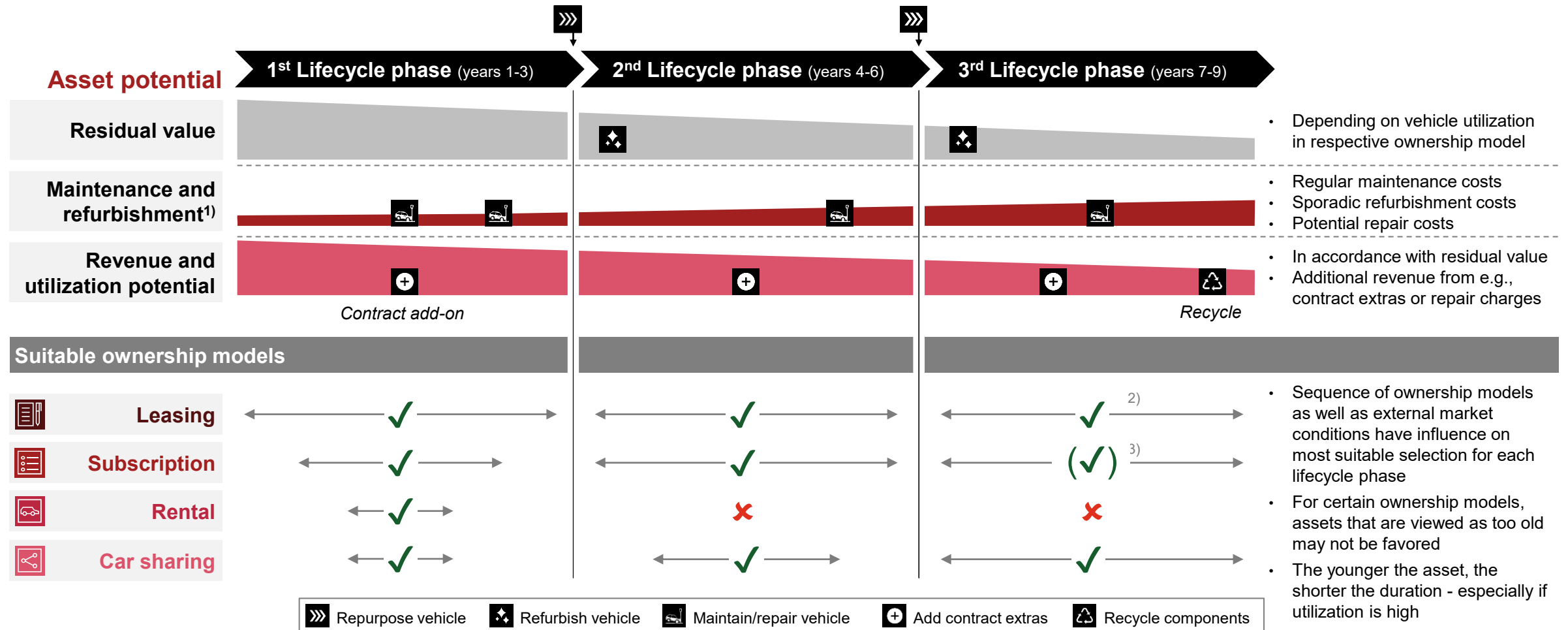
# As alternative ownership models such as subscription emerge, OEMs need to sharpen their vehicle lifecycle mgmt. skills

## Subscription customer and asset journey – Example



# Holistic vehicle lifecycle management aims to increase revenue and utilization, especially during 2<sup>nd</sup> and 3<sup>rd</sup> phase

## Subscription “3x3” asset lifecycle



- Depending on vehicle utilization in respective ownership model
- Regular maintenance costs
- Sporadic refurbishment costs
- Potential repair costs
- In accordance with residual value
- Additional revenue from e.g., contract extras or repair charges
- Sequence of ownership models as well as external market conditions have influence on most suitable selection for each lifecycle phase
- For certain ownership models, assets that are viewed as too old may not be favored
- The younger the asset, the shorter the duration - especially if utilization is high

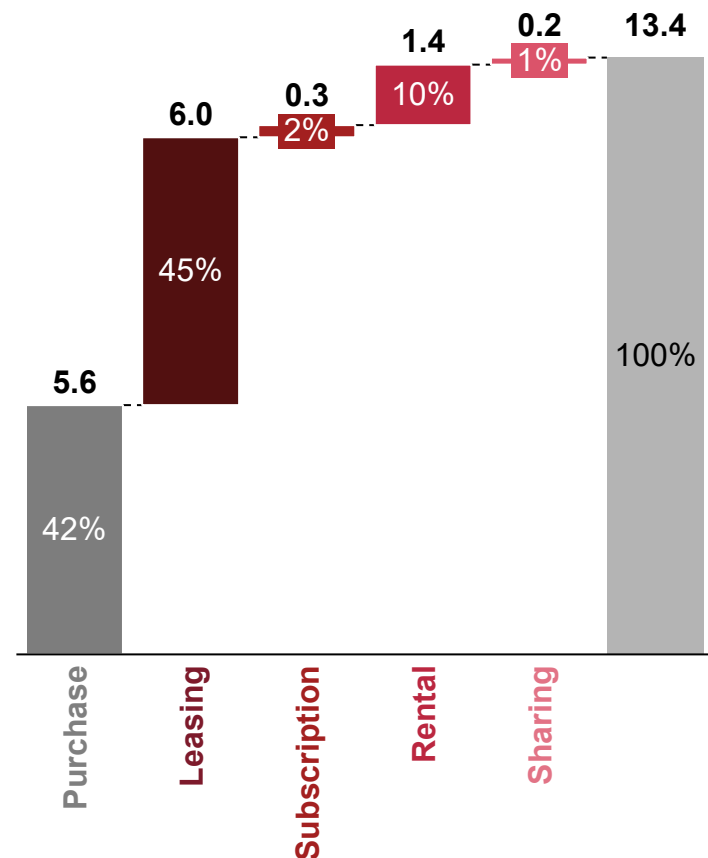
1) Annual OEM-prescribed maintenance/service intervals and use-based repairs – sporadic refurbishment;  
 2) Depending on specific regulatory environment allowing “prolonged lease”; 3) As low-budget option  
 Source: Strategy& analysis

# Alternative ownership models are on the rise and offer profit potential for OEMs – if the asset life cycle is managed well

## Vehicle ownership model split and profitability – Indicative

Ownership model split 2023 [m units]

Region Europe, 40 countries



**Subscription** has potential to grow to **2-4m units by 2035** in Europe<sup>1)</sup>

**Leasing** has potential to grow to **7-8m units by 2035** in Europe<sup>1)</sup>

Profitability of ownership models<sup>2)</sup>

Ownership models	Traditional car ownership		Alternative ownership		
	Purchase	Leasing	Subscription	Rental	Sharing
LCP 1 year 1-3	7%	-115%	-91%	10-15%	<5%
LCP 2 year 4-6	9%	83%	78%	–	<5%
LCP 3 year 7-9	11%	76%	71%	–	<5%
<b>Total</b>	<b>5-7%</b>	<b>10-15%</b>	<b>10-15%</b>	<b>10-15%</b>	<b>&lt;5%</b>



**Overall profitability potential higher for leasing, subscription and rental than for purchase**



**Profitability across LCPs varies – from relatively constant to a sharp increase. With rental, there is only one LCP.**

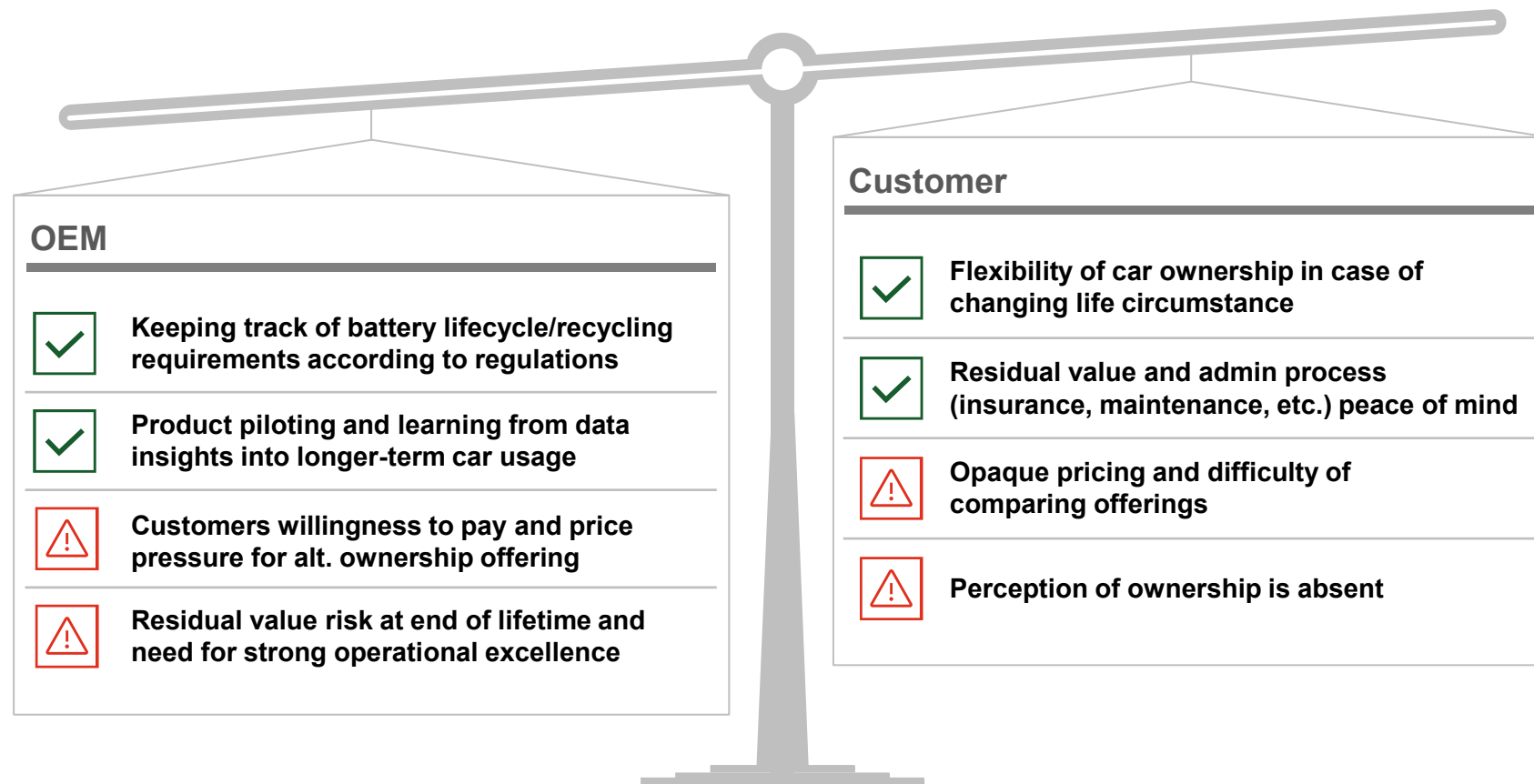


**It is not individual consideration but a merged portfolio view that is crucial for OEMs**



# More flexible ownership models offer benefits and risks for OEMs and customers – a win-win solution is required

## Vehicle subscription benefit and risk perspective



### Key takeaways

- Alternative ownership models need to create a **win-win situation** for customers and OEMs
- Currently, they mostly **play into the strategic agenda of OEMs**
- Strong **customer centricity** and efficient **asset management** of used cars are **needed** to reach **profitability**

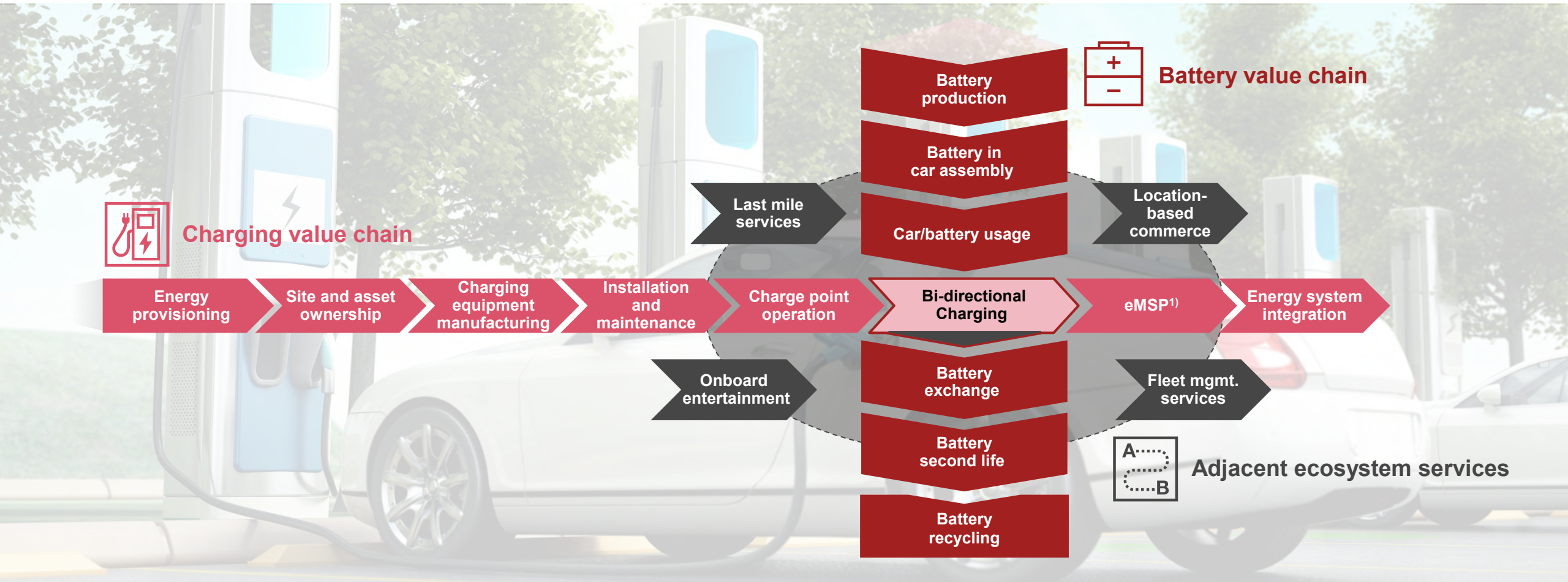
OEMs may leverage their existing retail network and preferential vehicle acquisition conditions to differentiate themselves from start-up competitors



*Going beyond the vehicle*

# Rise of e-mobility provides ample opportunities to capture value beyond the vehicle – e.g. with batteries and charging

## Value pools beyond the vehicle – Focus e-mobility

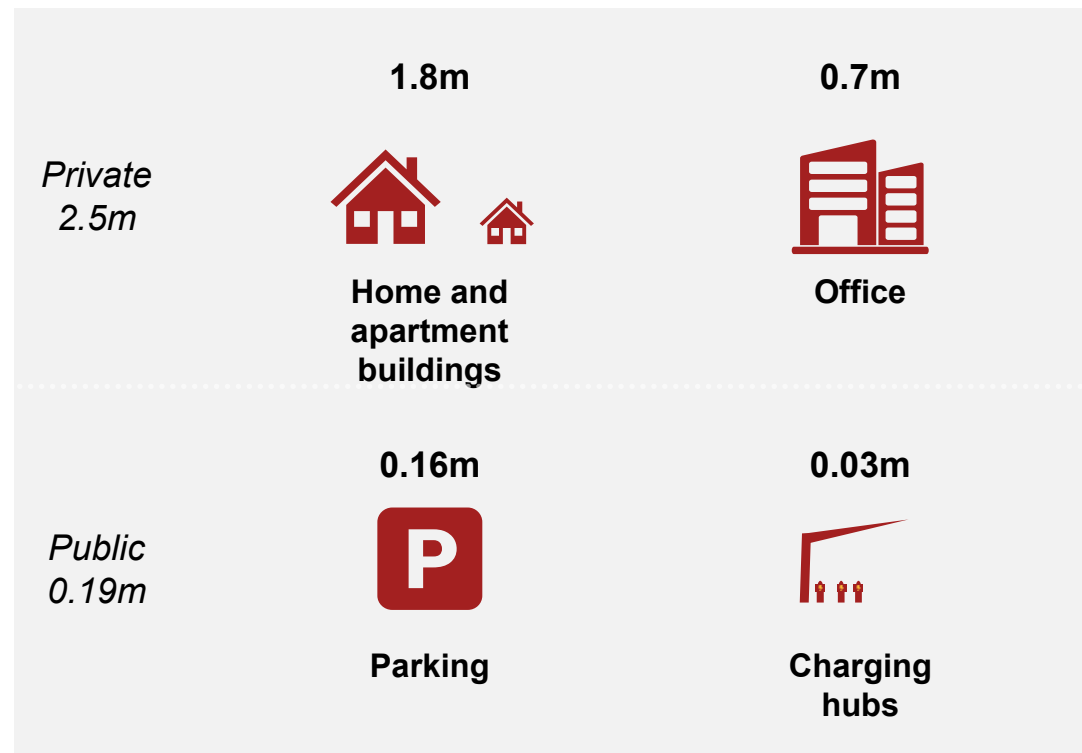


# Infrastructure and vehicle penetration are key requirements for successful realization of bi-directional charging use cases

## Bi-directional charging – Market simulation Germany



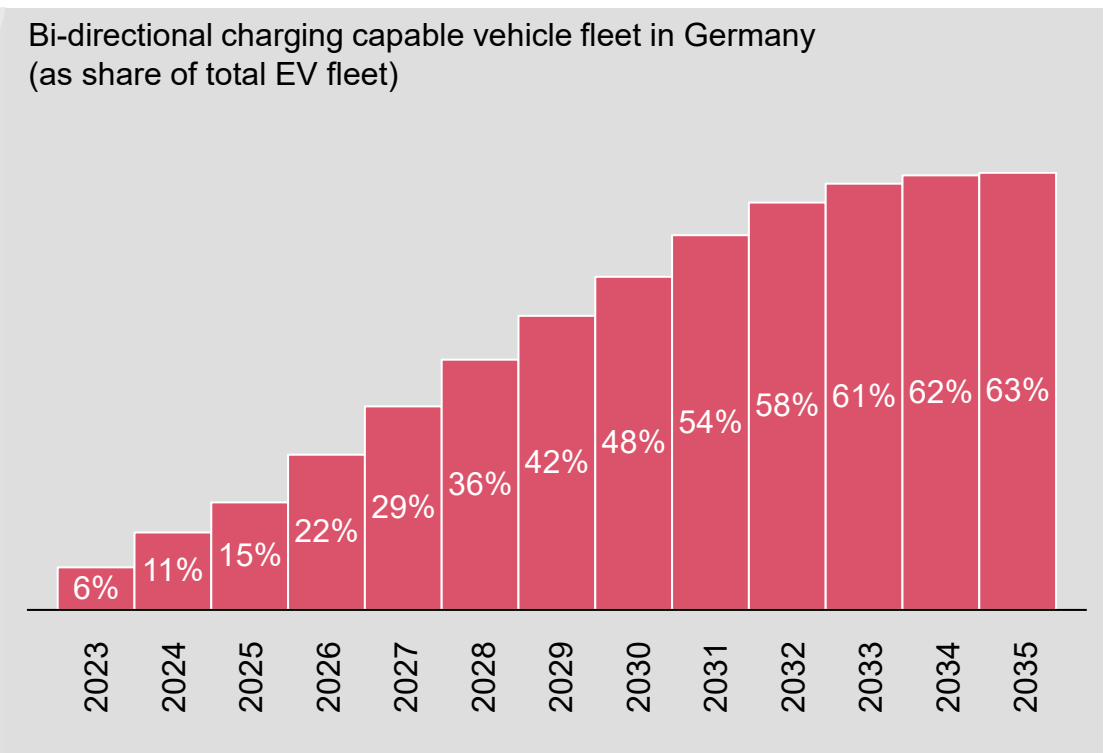
### Bi-directional sockets by 2030



**Total 2030: 2.7 million bi-directional sockets**



### Bi-directional charging-capable vehicle fleet (#)



**Total 2030: ~5 million bi-directional vehicles**

# Front-of-meter prosumer use cases depend on a multitude of external factors that limit mainstream adoption in short term

## Prosumer charging business model comparison – Germany



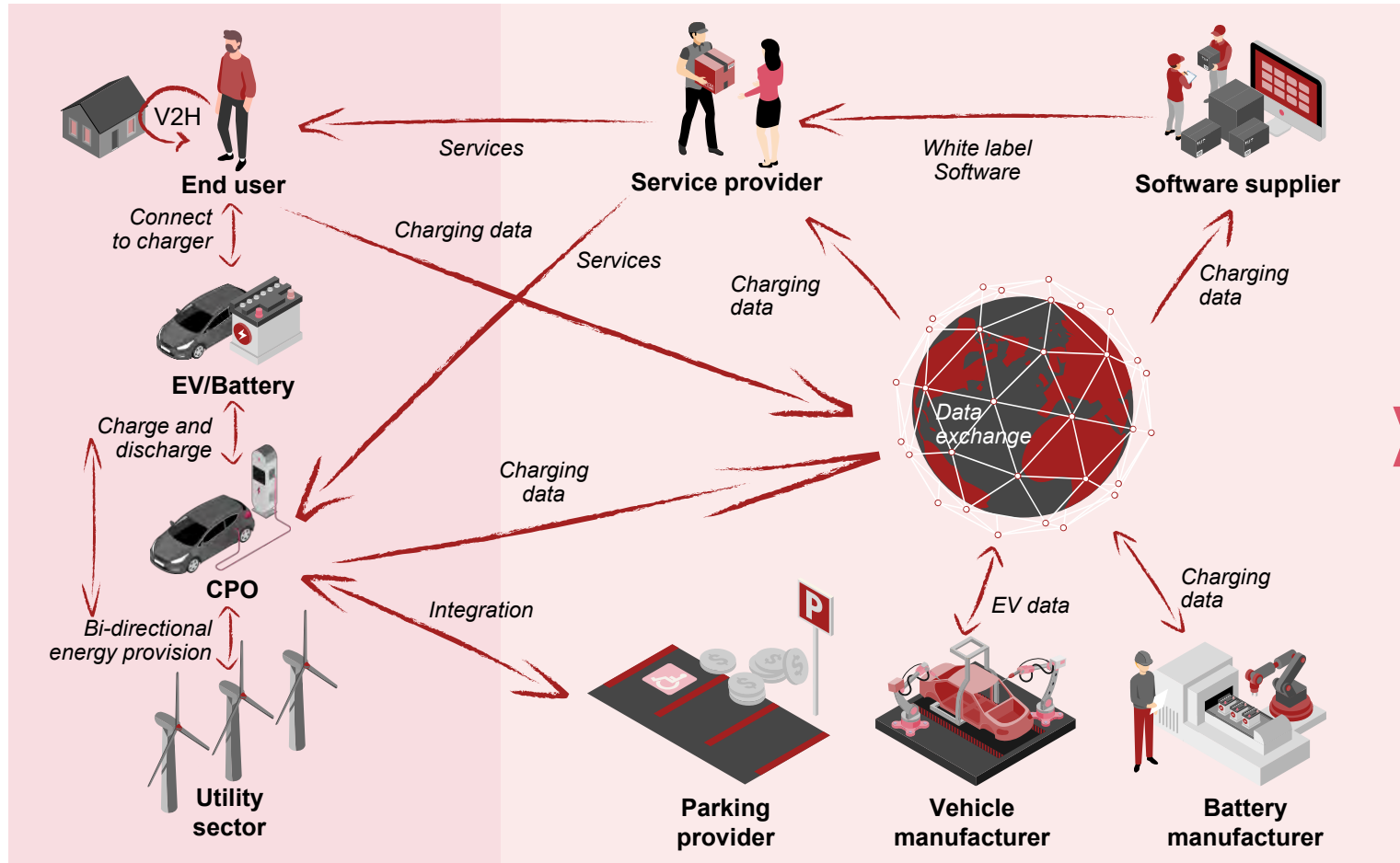
		Behind the meter		Front of meter	
Application Area		V2L	V2H/B	V2G / VGI	
Use Cases		Self-supply optimization	Consumption optimization	Load shifting	Power market trading
Enabler Revenues		Potential for software enablers: €160-220m <sup>1</sup> in 2030		Potential for software enablers: €470-550m <sup>2</sup> in 2030	
<b>Enablers &amp; Limitations</b>	Customer Demand	<ul style="list-style-type: none"> <li>• <b>Short-term: Growing EV user demand</b> to use vehicle e.g. as additional storage for home PV or emergency power bank (in the US)</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Mid-term: EV user demand driven by incentive to earn/save money, but depending on available solutions &amp; attractive pricing</b></li> </ul>	
	Energy Tech	<ul style="list-style-type: none"> <li>• Need for <b>penetration of bi-directional capable vehicles and infrastructure</b> (i.e. EV charger) to reach “critical mass”</li> <li>• Need for development of <b>standard protocols</b> (interconnection, communication, vehicle and charging station safety &amp; functionality)</li> </ul>			
	Regulation	<ul style="list-style-type: none"> <li>• <b>Fully supportive behind-the-meter regulation expected by 2024</b> due to limited complexity of “closed” micro-ecosystem</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Fully supportive regulation not expected before 2028 at EU level</b> due to high stakeholder complexity (smart meter as reference)</li> </ul>	
	Economics	<ul style="list-style-type: none"> <li>• <b>Tech cost reduction</b> (vehicle / infrastructure) required for scale up</li> <li>• Availability of comprehensive <b>ancillary services</b> as important enabler</li> </ul>		<ul style="list-style-type: none"> <li>• Need for <b>flexible V2G tariffs</b>: Time-of-Use or Time-of-Day pricing</li> <li>• <b>Minimum number of kwh</b> must be available at a certain point in time <b>for utility providers to rely upon</b> when managing the grid</li> </ul>	

While **front of meter** still requires more **regulatory alignment** at European level, **behind the meter** already has a **high market readiness in the short term**




Digital Auto Report 2023 Strategy&   
 V2L: Vehicle-to-load (e.g. e-bike, another EV, etc.)    V2H/B: Vehicle-to-home / building    V2G/VGI: Vehicle-to-grid / vehicle-grid-integration    PV: Photovoltaic   
 1) Includes software for grid optimization of households (V2H) and public charge point operators only; 2) Includes software for power market trading for households and public charge point operators only   
 Source: Strategy& analysis 37

# Realization and scale-up of prosumer use cases require efficient charging and battery stakeholder coordination

## Charging & battery ecosystem stakeholder activation



## Main scale-up challenges

- 
**Stakeholder fear of losing control points** to a central, dominant player (e.g. OEMs see USP in unique charging experience)
- 
**Relatively high transactions costs** for clearing and billing (given comparatively low value of single transactions)
- 
**Different interests and priorities** across parties (e.g. CPOs want to maximize utilization, whereas OEMs want to maximize charging availability)

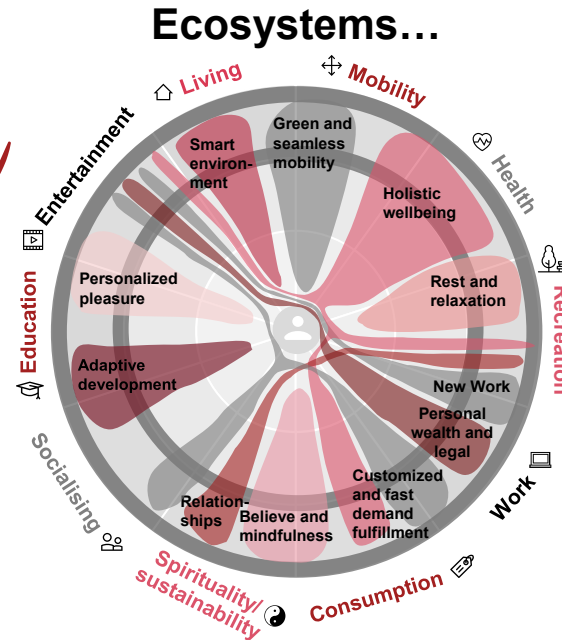
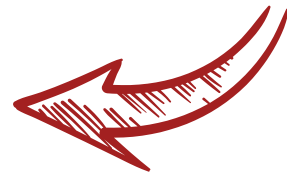
**Can a decentralized coordination approach help to solve these challenges?**

# Implication for automotive players: Holistic ecosystem approach beyond core business is key to future success

## On the one hand...



- Ecosystems can create lock-in effects based on **differentiated offerings**
- **Customer lifetime value** can be increased through holistic journey coverage
- **Faster growth and higher earning potential** can be achieved when compared with traditional approaches to value creation



## On the other hand...



- Building & managing ecosystems is **complex**
- Theoretically, unlimited number of potential offerings **complicates the selection process**
- Product-centric view carries risk of **missing market/customer needs** (particularly for more advanced topics)



## Success factors

- ✓ **Be clear about own ecosystem role – whether orchestrator, realizer or enabler**
- ✓ **Build offering portfolio and allocate resources** accordingly
- ✓ Maintain a **holistic and iterative approach** in the selection of suitable offerings
- ✓ **Actively manage the portfolio and prioritize clearly** according to a coherent, consistent and multi-layered ecosystem logic

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