



CAV and MaaS Respective missing links?

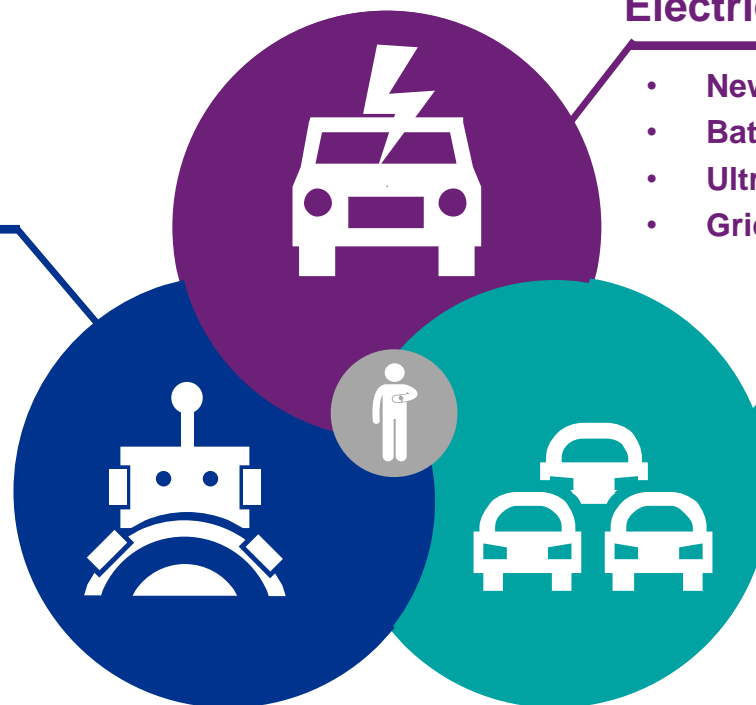
Ben Foulser, KPMG LLP

Converging technology is driving a transport revolution

Principal investment themes

Connected and Autonomous Vehicles

- AV capability development – ‘bolt-on’ and ‘ground-up’
- AV sensors and processing hardware
- Telematics and prognostics
- Platooning and driver-assist
- AV-enabled business models (e.g. robo-taxi fleets)



Electric vehicles & alternative powertrains

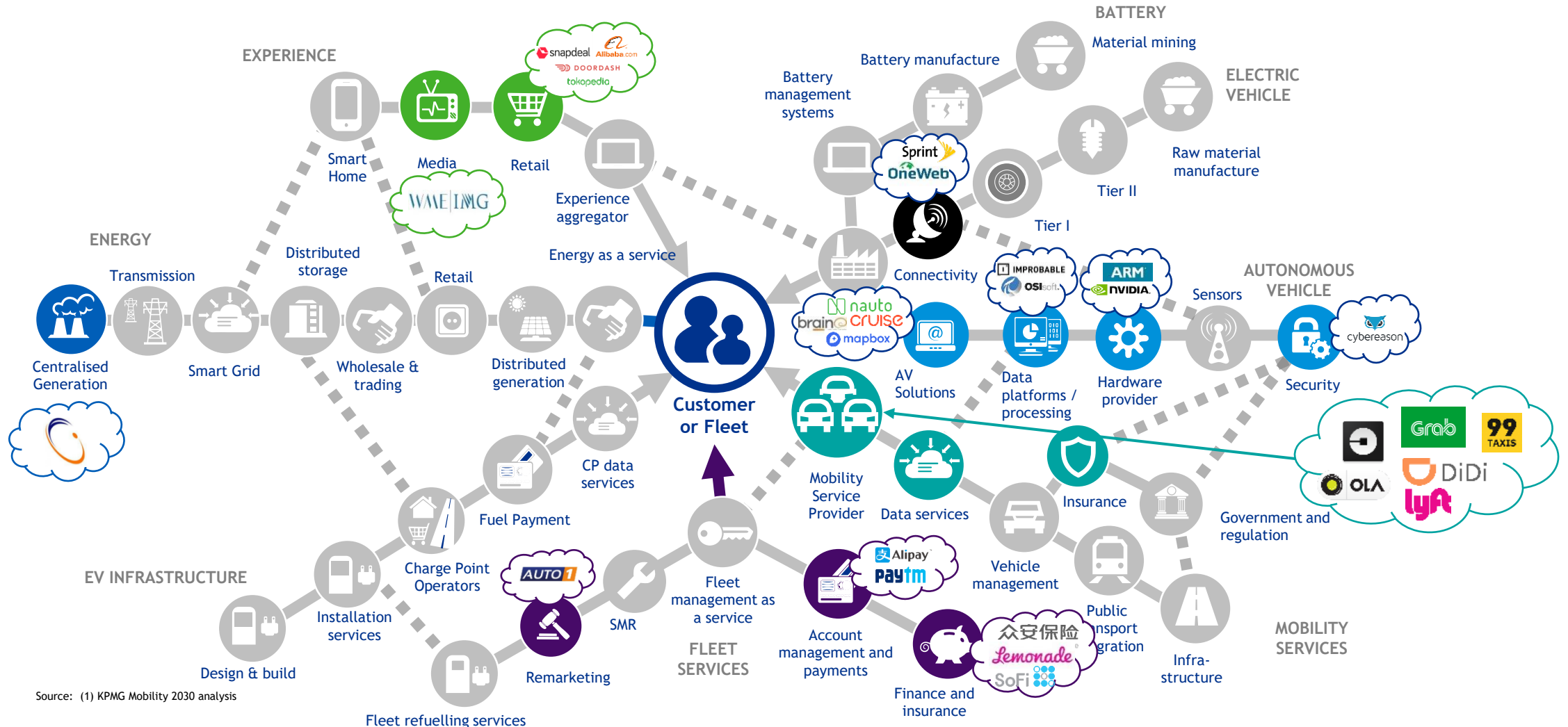
- New EV startups
- Battery technology and supply chain
- Ultra-fast charging network investment
- Grid reinforcement and demand management

On-demand mobility services

- New shared vehicle business models (ride hailing, car sharing, ride sharing, etc.)
- Consignment and freight sharing
- New data sharing platforms
- Public/private transport connectivity

Investment activity is accelerating across **all three** disruption areas

MaaS is closely interlinked with all aspects of the mobility value chain



Source: (1) KPMG Mobility 2030 analysis

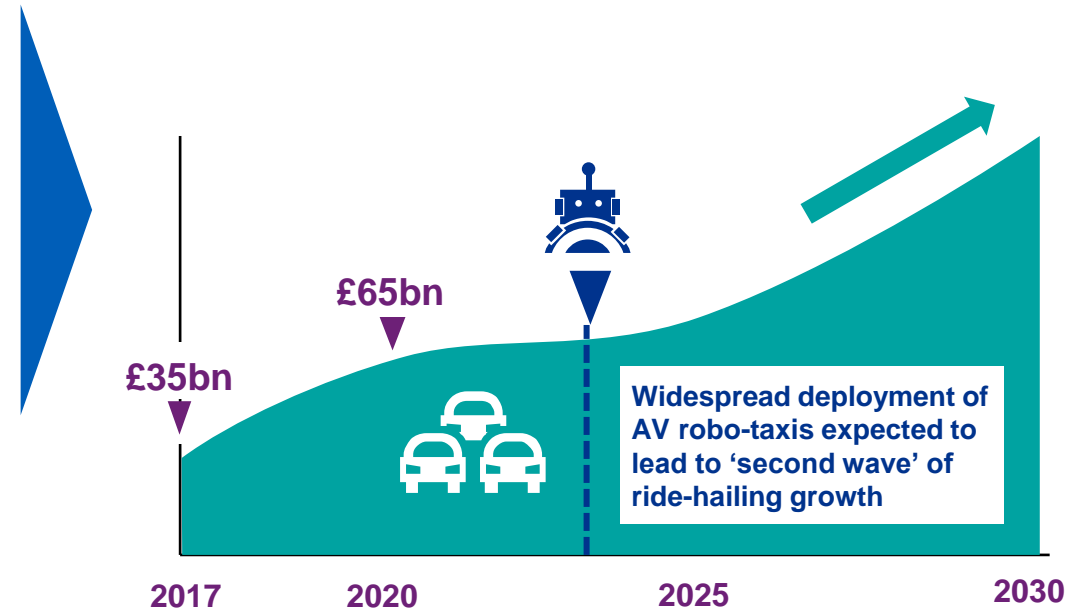
Ride-hailing is increasingly seen as a viable alternative to car ownership and its popularity will be reinforced through the introduction of AVs

Global ride-sharing¹ is expected to grow through to 2030, with the industry well-positioned to take advantage of emerging advances in driverless technology in the mid-2020's

Key drivers supporting global growth in ride-hailing:

- **Increasing urbanisation** – driving lower car ownership and utilisation, due to inner-city congestion and public transport availability
- **Global economic development** – driving the growth of the global middle class and corresponding demands for transport
- **Changing consumer preferences** – increasingly demanding flexibility, real-time responsiveness, transparency in products and services
- **Improved economics** – primarily enabled by the development of L4 autonomy, allowing driverless 'robo-taxi' fleets to deliver journeys at much lower unit cost, creating a viable alternative to vehicle ownership

Expected global ride-sharing market evolution (2017-2030)



Notes: (1) Includes ride-hailing (e.g. Uber), ride-pooling (e.g. Uber pool, ViaVan), digital taxi hailing services (e.g. Gett). Excludes car-sharing and traditional taxi services.

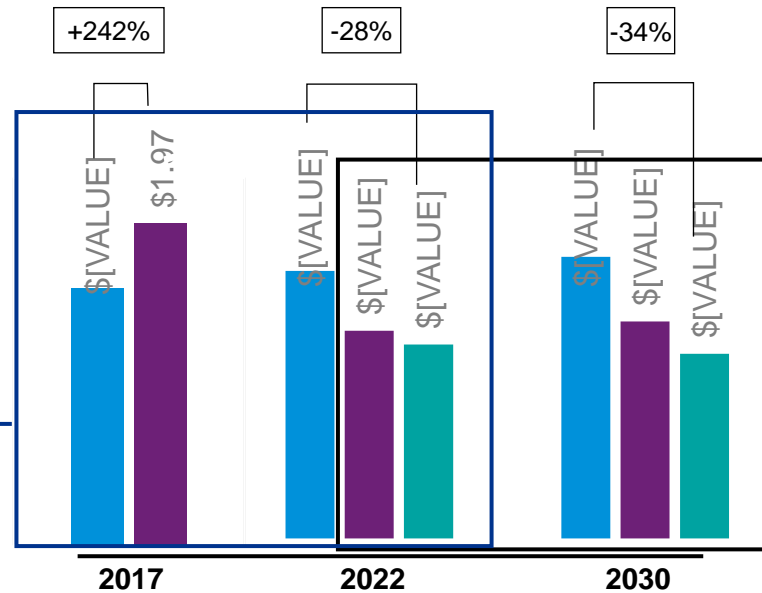
Sources: (a) Statista (b) KPMG analysis

Removing the driver will accelerate adoption (and de-carbonisation)

Ownership: The First Transition

- Cost per mile of MaaS is initially higher, because of convenience factor
- Increased MaaS adoption reduces value of personal vehicle ownership

Normalised cost per mile



■ POV*/ICE sedan ■ MaaS (Uber) ■ AV/EV MaaS

*Personally owned vehicle (POV)

Driver Removed: The Second Transition

- High utilization of vehicles in AV MaaS in fleet settings will lead to EV cost per mile advantage
- Battery cost and range continue to improve, magnifying this effect

On demand personal mobility is creating value pools

San Francisco Uber captured \$1B from a \$200M local taxi market in 2016



The car remains the most important element of the MaaS solution; however, alternative modes will be required for scaled deployment

Car-based services will remain a centrepiece of passenger transit...



- ✓ **Faster/more direct journeys** – saving on travel time for consumers in a rush
- ✓ **Convenience and freedom to travel** – based upon own schedule / plans
- ✓ **Can go where public transport cannot** – e.g. rural areas that cannot be served economically
- ✓ **Flexible to individual needs** – e.g. for less-abled passengers or families.

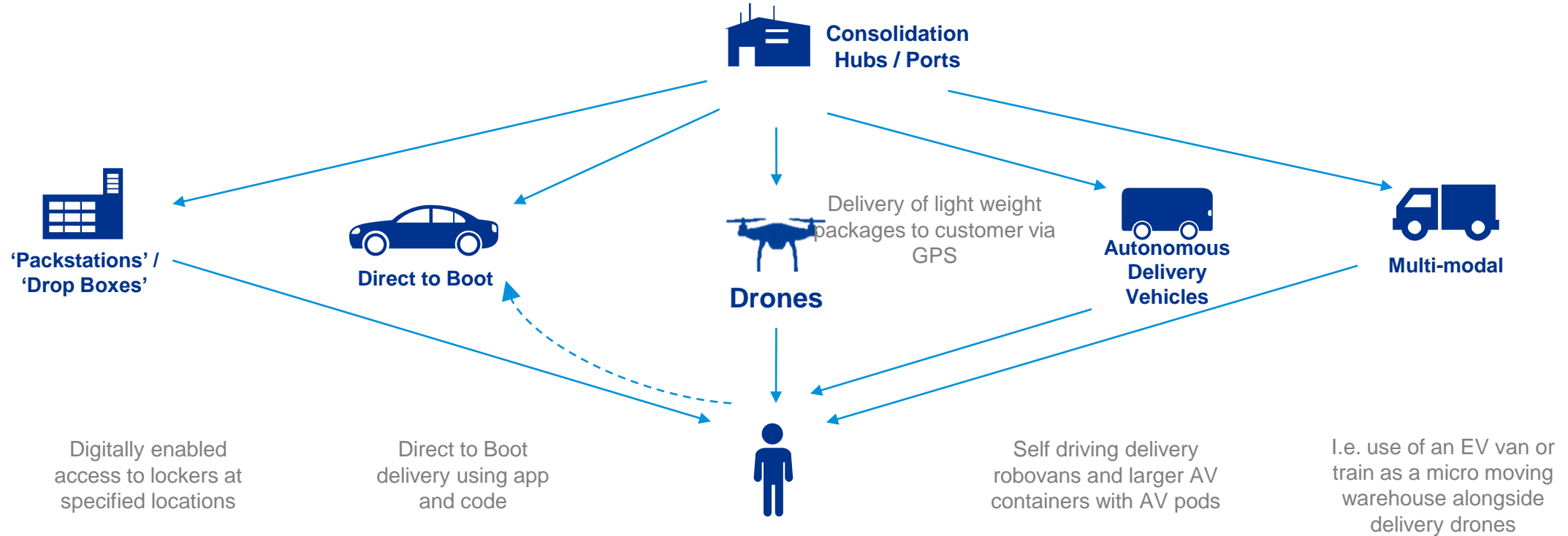
...but scaling traditional ride-hailing solutions creates a number of social issues

- ! **Increase in congestion and emissions** from rapidly growing robo-taxi fleets **50%** **Increase in traffic** expected in Lisbon under individual AV-taxi scenario^(a)
- ! **Lack of ‘rush-hour’ capacity** due to concentration of commuter demand **80%** **of ride-hailing journeys** still only have a single passenger^(b)
- ! **Declining revenue for public transport** as consumers migrate away from rail, bus **↓6%** **Decline in public bus use** in the US attributed to ride-hailing^(c)
- ! **Unequal access for passengers** that cannot afford such services, leading to social stratification **550%** more ride-hailing trips are taken by **individuals earning >\$200k vs. <\$15k**^(d)

We believe that a different solution will be required for true ‘mass-market’ scale

Sources: (a) International Transport forum (b) Boston Metropolitan Area Planning Council (c) CityLab (d) Schaller Consulting

Drones and AVs are changing how goods are moved



Digitally enabled access to lockers at specified locations

Direct to Boot delivery using app and code















Self driving delivery robovans and larger AV containers with AV pods

I.e. use of an EV van or train as a micro moving warehouse alongside delivery drones

Examples



Pilot launches of MaaS

City	Mobile App for MaaS	Provider
Helsinki, Antwerp, West Mids	 Whim app	Maas Global 
Gothenburg, Stockholm	 UbiGo	UbiGo Innovation AB / Fluidtime 
Hamburg Stuttgart	 ReachNow	Daimler AG and BMW Group 
Singapore	 Beeline	Infocomm (IDA) and LTA 
Vienna	 SMILE	Wiener Stadtwerke OBB 
All cities in Germany	 Qixxit	Deutsche Bahn 
North America	 Transit App	Transit 

Singapore



3rd highest global population density



Built a model city specifically for AV
MaaS and mobility testing



Road Traffic Act allows AVs to be
tested on public roads and used in
MaaS platforms



AV Production deal between
Nutmomy (MIT spin off) & Peugeot



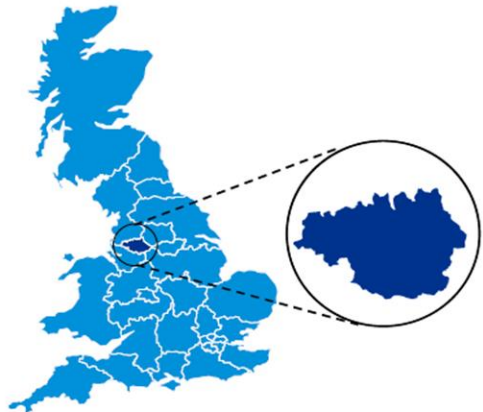
What could it unlock?

MaaS and AV has the potential to drastically change the landscape of Greater Manchester ("GM") by 2030



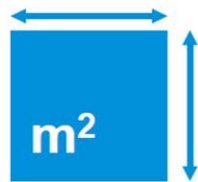
50K

There are currently c.50k public parking spaces in GM's 10 key centres⁽¹⁾, which is equivalent to c.580k m²



By 2030, MaaS and AV will reduce the number of personal vehicles by

up to 20%



c. 120K m²

of space in GM's key centres will be available to be repurposed as a result

This space could be used to build up to 4k additional homes

c. 4k





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