MOBILITY TRENDS 2023

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Let’s celebrate the light and the life

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The last stars will die out 120 trillion years from now (at most), followed by 10^106 years of just black holes

Hello*

we are astara INTELLIGENCE

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2022 (is over).*

It was the year that we (finally) properly left behind the pandemic, at least from the point of view of the collective subconscious, despite peaks in the incidence rate of the virus in various places around the Globe.

We have now learnt to live with Covid and with the fallout that it has left in our societies. What a social experiment! Humanity has proved its capacity to adapt quickly to ever-changing environments that few could have imagined just 3 years ago.

We thought that once the pandemic was over, we'd be happy and calm again.

But it's now dawning on us that this change upon change upon more change has only just begun. Wars, energy crises, supply crises (especially of raw materials), the devaluation of technology companies and their massive layoffs (unseen since the ".com" crisis).

But let's not kid ourselves, the disruption and dominance of tech companies will be even more profound over the next few years than it has been to date, inflation, artificial intelligence.

Also, generative AI, which is not widespread yet, but it is already starting to put thousands of jobs at risk. Examples include Open AI with Dall-E and ChatGPT. Does anyone really think it's a coincidence that Microsoft laid off 10,000 employees on 18 January 2023 and 5 days later announced a $10 billion investment in OpenAI?

You could say that we are on the verge of the advent of a new world order.

It is something of a difficult order to describe at this stage, since its boundaries and configurations are being drawn and redrawn by the day. But a couple of tenets are already emerging. Firstly, the center of world power is shifting East (specifically to China and India). And, secondly, we can expect to see more armed conflicts, a fruit of geopolitical tensions and the desire to control certain key materials for strategic markets (e.g., water, lithium, copper, rare earths, aluminium, chips & semiconductors).

From the point of view of metals alone, BloombergNEF defines an opportunity of $10 trillion given the relevance of certain metals for the energy transition. It is notable that the vast majority of these raw materials are not found in the nations that have hitherto dominated the planet and so we can expect to see extreme moves to gain control of supplies.

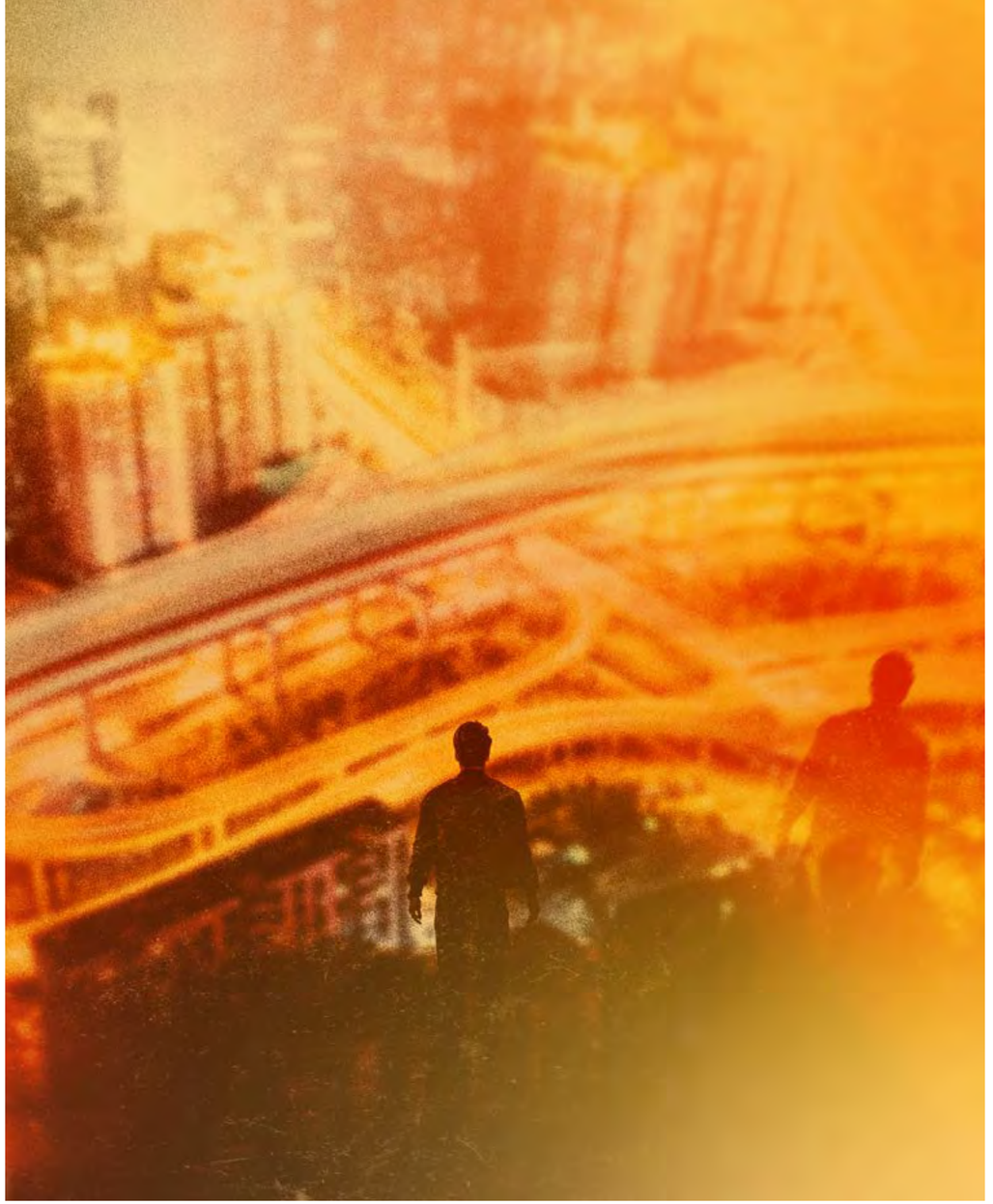
We are leaving a few years where the key word has been resilience, already hackneyed and almost denatured by the abuse of use, with other concepts adding to this.

Resilience is about returning to the initial position or shape after a factor subjects us to stress. Therefore, it is reactive.

Faced with the multitude of changes and the current level of uncertainty, people and organizations cannot take only reactive stances. They must have proactive and reactive mechanisms. Observation, adaptability and efficiency are going to be key to not only surviving changes but also being able to lead them: observation to detect what is happening, adaptability to test the scope of any changes and, efficiency to generate models that make the most of our limited resources and assets, to generate sustainable schemes that offer us independence.

Regarding mobility, we are affected by all this macro structure of changes. Each change in the way of consumption, each change in the behavior of individuals and groups, each new technology has a direct impact on mobility. We are an industry of transversal nature. A facilitator of any other economic and social activity. It becomes overwhelming to reflect on the number of changes we have undergone since 2015. And to be aware that we are not even halfway there and hat the changes that generate new configurations have only just begun. We have exciting decades ahead of us.

In summary, the current change is of an incalculable depth. Perhaps at a cumulative level, the changes we shall live through over the next decade will be the greatest experienced by humanity in its entire history. Faced with this scenario, we will all need to keep our eyes, ears and minds wide open. We will need to be agile and flexible to not only survive the changes, but also to lead them.



Zygmunt Bauman's liquid world has never been more real and, when faced with liquidity, it is best to flow

Πάντα ῥεῖ

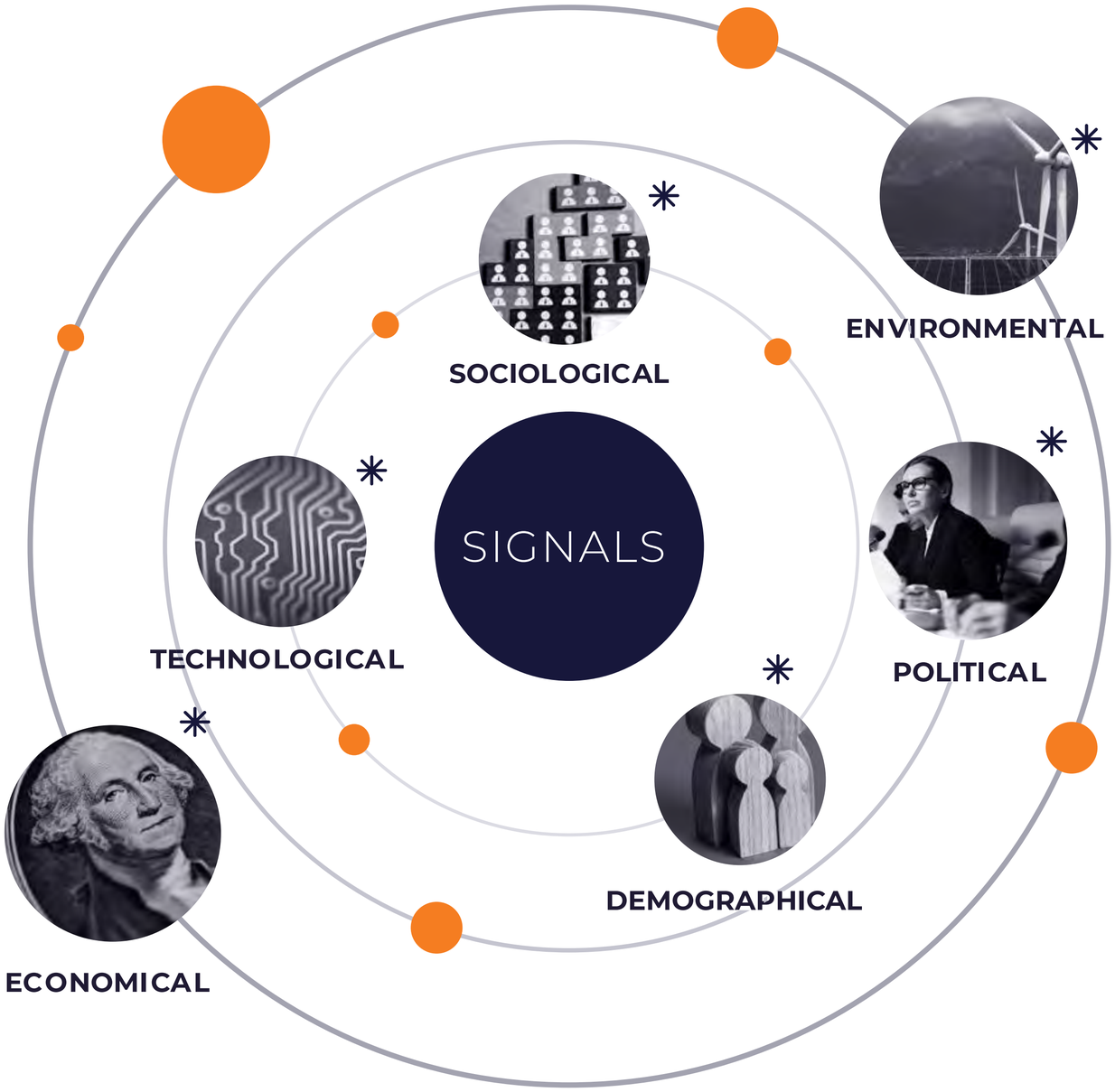
Trend

(noun) a general direction in which something is developing or changing with long-term impact and transversal impact across different industries.

1. Signals
   I. Quantitative
   II. Qualitative
2. Methodology
3. Related macro trends

What is a **TREND***

QUANTITATIVE & QUALITATIVE



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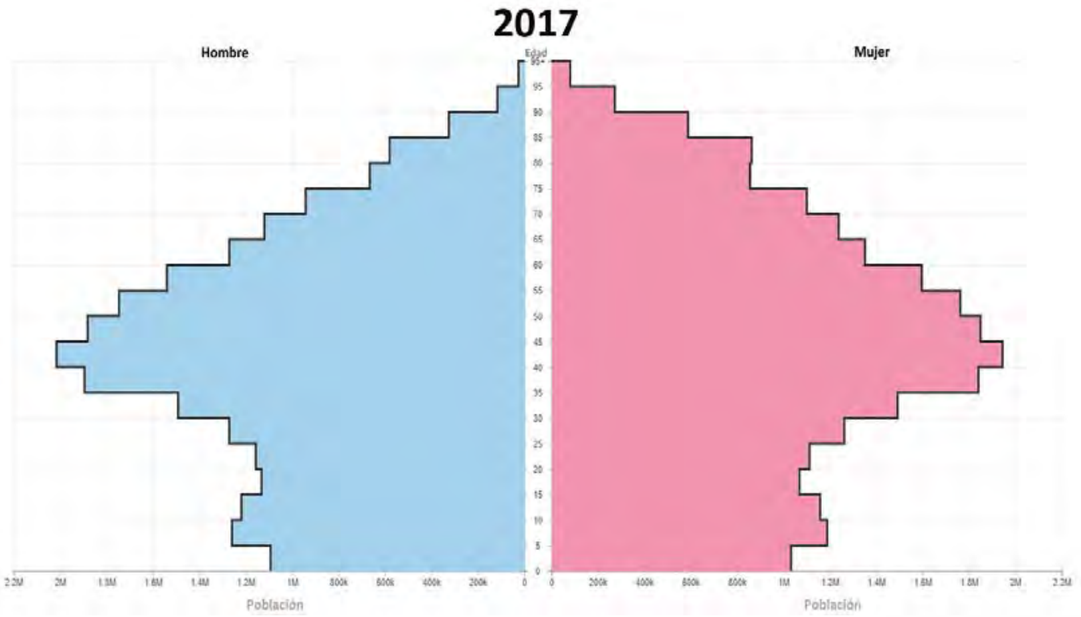
SIGNALS

QUANTITATIVE

Data, facts and figures coming from reliable sources that shown the evolution or changes in a certain topic.



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QUALITATIVE

Narratives created by different leaders of opinion (companies or people) that generate a vision about a topic.

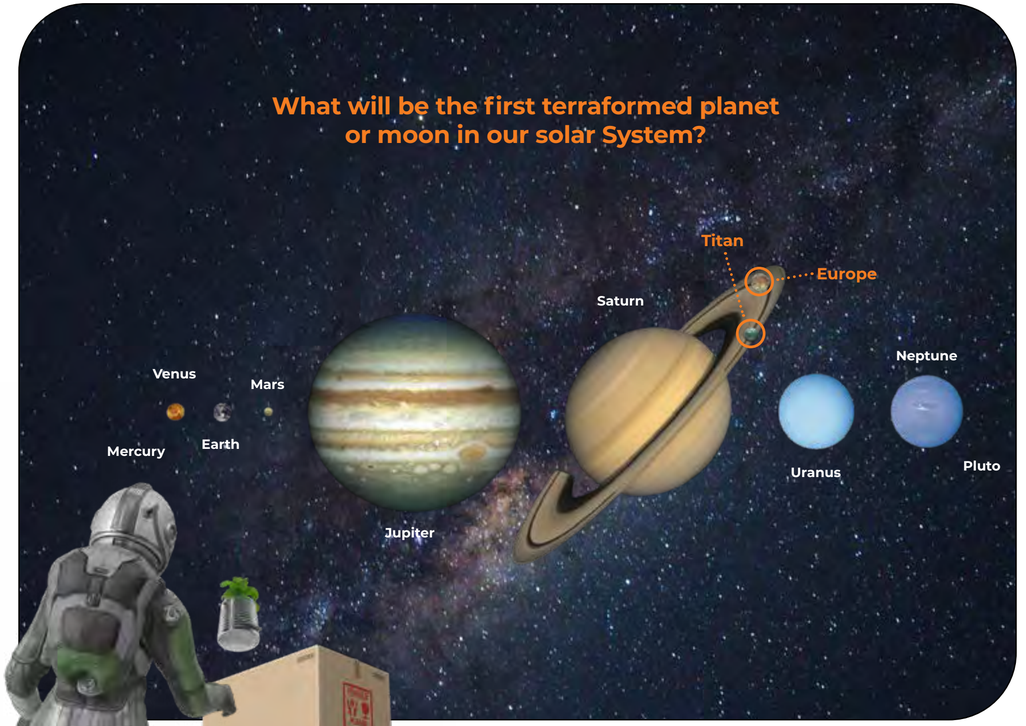
Narrative by default includes **cognitive biases** of people who generate it. This means that they do not produce the **fairest or most efficient outcomes.**

Connected products

Autonomous vehicles

Sharing Car/ Ride

Electrification



Welcome to 2030.
"I own nothing, have no privacy, and life has never been better".

-Ida Auken, Member of Parliament, Denmark

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METHODOLOGY

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RELATED MACRO TRENDS

REDEFINING GLOBALIZATION
Navigating a geostrategic landscape

DATA & CONNECTIVITY
Digital domination versus data debates

NEW BUSSINESS MODEL
Transitioning to new opportunities

CIRCULAR & REGENERATE SYSTEMS
Designing for reuse, reclycling

AGING SOCIETIES
As people live longer, new challenges emerge

DECARBONIZATION
Prioritizing a carbon positive future

CLIMATE CRISIS
Why it´s time for bold science based decision making

EXTENDED REALITY
Towards a digital tipping point

AI & ROBOTS
Tech advances herald a new world

WORK DISRUPTED
Tech advances herald a new world

WEB3
A decentralized vision of the internet

URBANIZATION
Tech advances herald a new world

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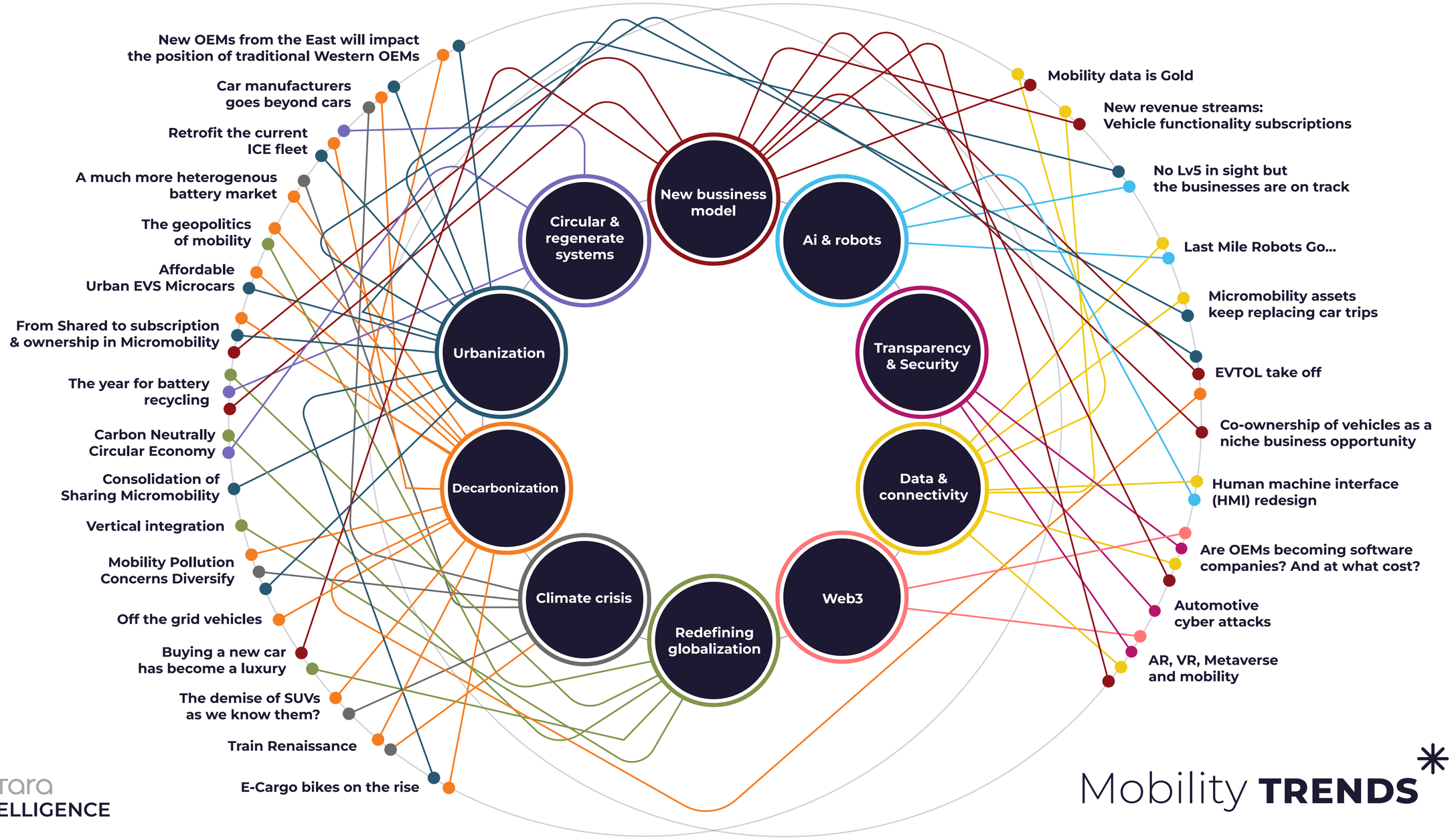

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Mobility **TRENDS**

Mobility **TRENDS**

CAR MANUFACTURERS GOES BEYOND CARS

DESCRIPTION

Traditional OEMs have been manufacturing in the same vehicle segments for decades: cars, light commercial vehicles, and trucks. But this is now changing. Over the last two years, many OEMs have started to envision and design ebikes. With the market for bikes and ebikes breaking sales records year after year since the pandemic, traditional OEMs have decided to broaden their product portfolio to include micromobility assets.

People are buying more bikes and e-bikes than ever to commute, as a clean and active mobility option, and because they are way cheaper than a car in terms of ownership and operating costs. E-bikes are also a brilliant option for older adults and/or those in sub-optimal physical shape. here are benefits for the OEMs too: the assets are significantly less intensive in terms of raw materials and manufacturing and the market could also be very lucrative. For example, **[Rivian]** reported that it could manufacture 300 e-bikes with an **[estimated]** retail value of $1 million if it were to split the battery from just one of its $65K pickups trucks.

RELATED MACRO TRENDS

- **URBANIZATION**
- **CLIMATE CRISIS**
- **DECARBONIZATION**

YEARS TRACKED

1

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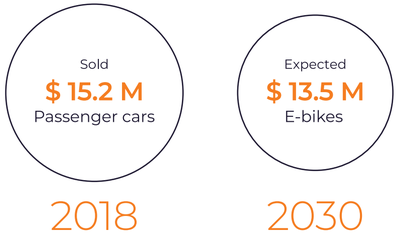
In Europe forecast said that By 2030

The pedalling market is expected to grow to **13.5 million** units sold annually

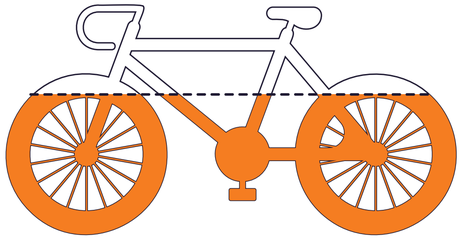


In comparison, the European automotive industry sold 15.2 million passenger cars in 2018

24% of European commuters would consider switching to an e-bike

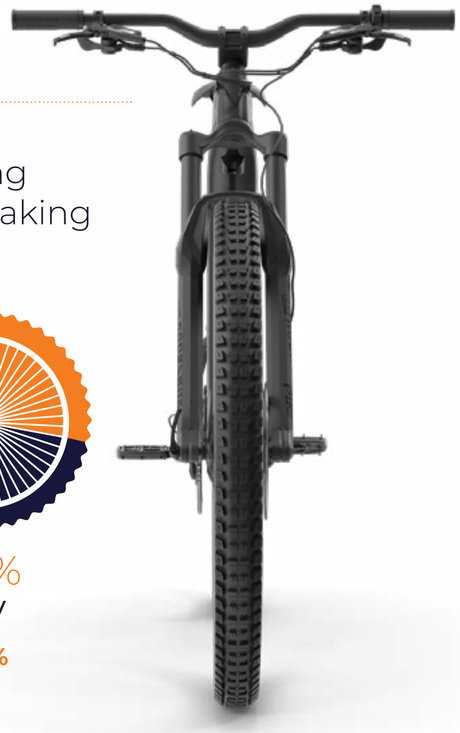
Renault Trucks are manufacturing and distributing ebikes, and Audi, Mclaren, Porsche (Fauza), Aston Martin, Alfa Romeo, BMW, Peugeot, Jeep, Ford, Volvo, Renault, Mercedez, Land Rover, Hummer, Lamborghini, Rivian (which, by the way, could manufacture 300 e-bikes with an estimated retail value of $1 million, if they were to split the battery from just one of their $65K pickups) and even Tesla are thinking about following suit. All these classic automotive brands have been working to develop e-bikes in recent years.

Bike commuting is the **3° most popular U.S.** transportation mode



Netherlands leads the charge of pedalling charge with **47%** who would consider making the switch to e-bike commuting

Spain comes in just behind with 39%, and Italy at 33%



Renault trucks now assembles and distributes e-cargo bikes with kleuster

Audi E-bike, the electric bicycle with Internet connection

Porsche purchase Fazua

BMW Cruise E-bike

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RETROFIT THE CURRENT ICE FLEET

DESCRIPTION

The enormous pressure on the EV value chain to achieve transport decarbonization, and therefore cut the sector's greenhouse gas emissions **which accounts for 16% of all emissions globally and up to 30% in certain regions such as the EU** [🔗], is being addressed by the tactic of creating new vehicles from scratch.

But, we already have millions of ICE vehicles on our streets and those vehicles could be updated internally and externally at a relatively low cost. By retrofitting, we refer to any activity that gives a vehicle a second life through repair and/or replacements. And three main business lines are already emerging in this space: the substitution of old combustion engines with some kind of electric powertrain; installing special filters to reduce the emission of thermal exhausts; and the re-conditioning of the interior and exterior of vehicles to give them the look and feel of a new vehicle.

In this vein, the French startup, Transition One, states that it costs **€15,000 to retrofit a vehicle** [🔗] and that, in a mass process, that figure could fall to as little as €8,000. Meanwhile, the Spanish firm IC2EV reports that the cost of retrofitting a Mini amounts to €10,000; for vans, the cost ranges between €14,000 and €16,000. That is equivalent to one-third of the price of a new Mini.

The retrofitting market is likely to grow, bearing in mind that the manufacturing facilities of most EV OEMs are unable to meet demand. Cities are embracing mobility models that ban polluting vehicles, especially in the EU with the introduction of Urban Vehicle Access Regulations (UVAC); most of these schemes include Low Emission Zones (LOZ) which the majority of the current vehicle parks do not comply with. Furthermore, impact investors are not yet prepared to support EV manufacturers. They tend to avoid industrial, hardware, and CAPEX-heavy investments. However, retrofitting will not require significant investments (in terms of manufacturing proces and raw material consume) to achieve its objectives. Lastly, a significant number of countries are phasing out the sale of ICEs by 2030; this will put more pressure on the system and boost the support for retrofitting as a plausible solution.

RELATED MACRO TRENDS

- **CIRCULAR AND REGENERATIVE SYSTEMS**
- **DECARBONIZATION**
- **URBANIZATION**

YEARS TRACKED

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SIGNALS

Retrofitting represents a sub-trend inside the broader concept of the Circular Economy, which aims to create businesses in which most of the processes and materials are reused or recycled. High-profile OEMs, such as Renault and Seat, are embracing the circular economy and, therefore, adapting their manufacturing plants and value chains to it. Specifically, Renault has adapted its **Re-Factory in Flins (France)** [🔗] and its facilities **in Seville (Spain)**. [🔗] At the plant in Spain alone, Renault plans to refurbish 11,000 used vehicles per year. Meanwhile, **SEAT announced** [🔗] this year that it will launch a similar project at its factory in the "Barcelona Zona Franca." Initially, the company will only refurbish used cars (both its brand and those from the wider Volkswagen Group), although battery packs will also be repaired, reused, and recycled later on.

TOLV

Launch the electric retrofit of commercial vehicles at the Re-Factory in Flins.

🔗

Equipmake

A bus retrofit company form UK, is able to retrofit 5 diesel buses to electric per week for £200,000. A new conterpart new bus will cost £400,000.

🔗

MAGTEC
ELECTRIC VEHICLE DRIVE SYSTEMS

Has converted a city sightseeing bus to electric, providing annual environmental savings of 33 tonnes of CO2 and 535 kg of nitrogen oxides (NOx), as well as an annual cost saving of £20,000 due to using electricity instead of diesel.

🔗

STELLANTIS
QINOMIC

Stellantis & Qinomic consider electric transporter conversions

🔗

In April 2020

French regulation was modified to allow the retrofitting of vehicles.

Plus a maximum of €5.000 subsidie 🔗

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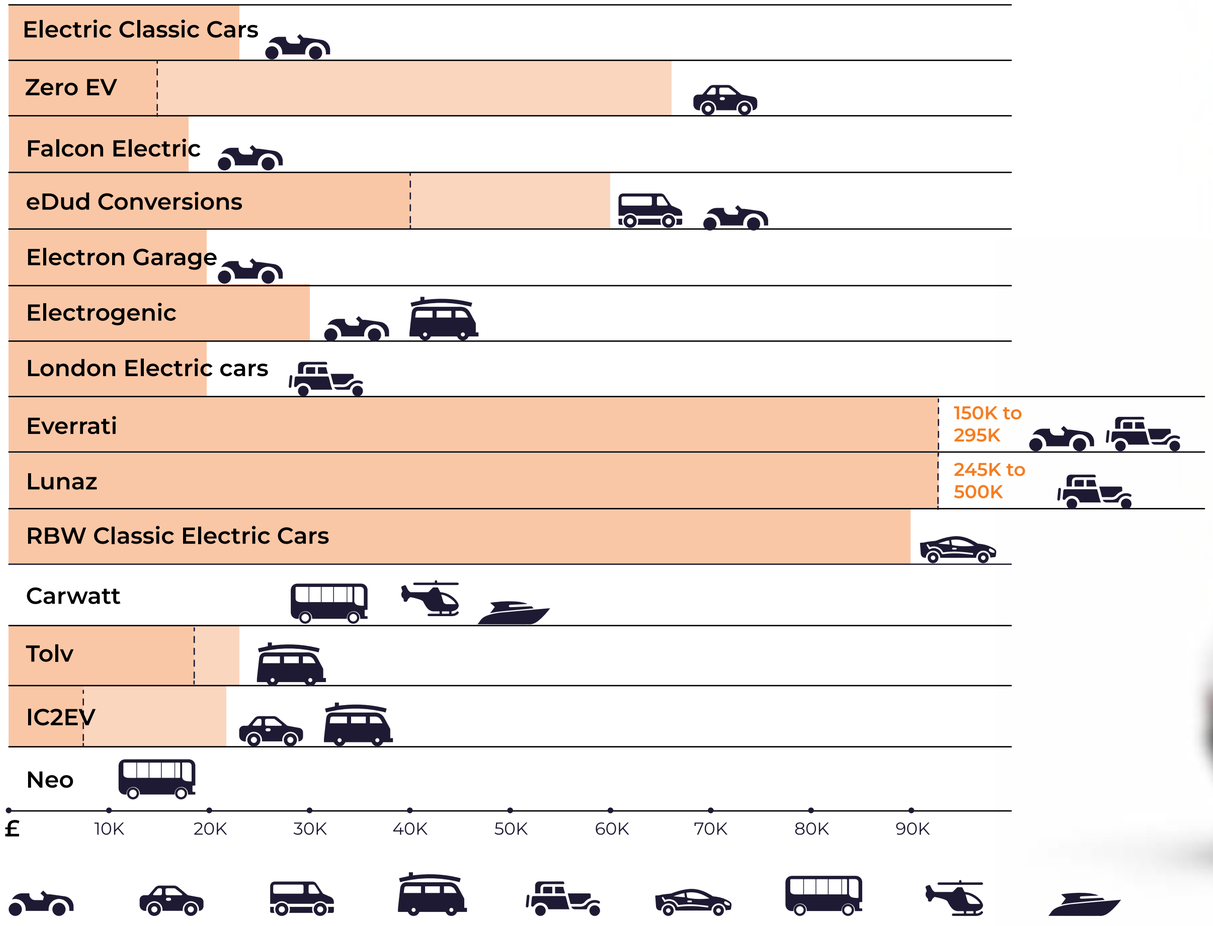

NO LV5 IN SIGHT BUT THE BUSINESSES ARE ON TRACK

DESCRIPTION

In order to create a genuinely fully autonomous vehicle, we first need to achieve General Artificial Intelligence (GAI), which basically means an artificial intelligence that is capable of matching human intelligence. If that is ever possible, fundamentally because we do not yet even know how human intelligence works or how it develops (if you want to learn more about cognitive science, be sure to check out **this symposium)**. [🔗] GAI would involve a machine facing any kind of situation and deciding how to overcome or resolve it. Right now, AI works spectacularly well when we use it to solve a specific task. And that is especially true when we want it to solve problems involving analyzing an image, but it really struggles when required to interpret natural language (text). Although the challenge is not just this. Is quite more complex. Multiple source signals, obstacles, multiple moving object split second decision making, computing all variables, weather conditions interfering, software malware, etc...

Having established that GAI, and therefore fully automonomous vehicles, are still a pipe dream for now, we want to be clear that this does not mean that AV-based services are scaling down or scale down their plans. Setting aside important shutdowns, such as Argo AI, other companies are starting to create real commercial services that generate income. Here, Cruise deserves a specific mention. Motional, Waymo, EasyMile, and Navya are some of the key players offering commercial services in this space, or coming very close to doing so. In the next few years, a clear difference in how these services grow will be defined mostly by regulations and public policies.

Meanwhile, services are going to be dominated by robo-taxi (Uber-like services without human involvement, albeit inside the vehicle) in the USA; and by robo-shuttles (group transportation services) in the EU. In both cases, remote operation (by remote operating companies such as Phantom Auto) will need to be integrated for security and reliability purposes, however, these are not enough as the cyber risk of hijacking those controls remains a possibility.

RELATED MACRO TRENDS

- URBANIZATION
- AI & ROBOTICS

YEARS TRACKED

1

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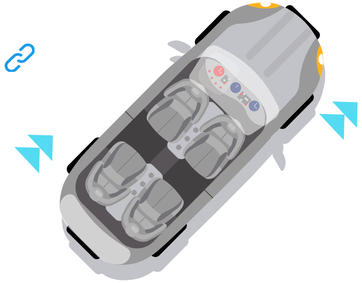
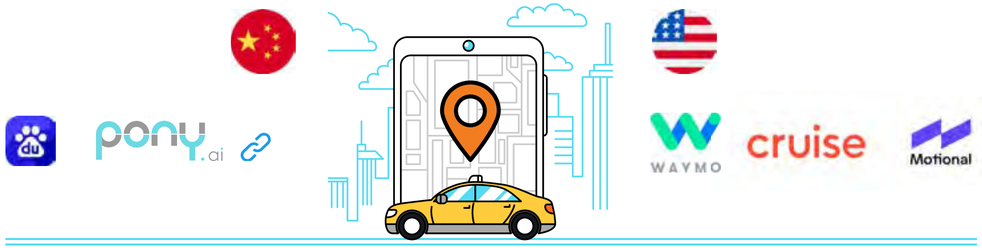
The total global investment in autonomous vehicle(AV) technology

exceeds $200 billion



Companies with gubernamental permission to offer commercial robotaxi without safety driver



Full System

Pre built maps

AIMOTIVE · 智行者 · OXBOTICA · pony · tu simple · ROADSTAR.AI · drive.ai · AURORA · MOMENTA

Pre built maps

Faraday Future · nuro · ZOOX · may mobility

Localization

Pre built maps

Civil Maps · DEEPMAP · Ushr · CARMERA · swift

Perception

Light detection & ranging (lidar)

LeddarTech · Velodyne · INNOVIZ · QUANERGY · blackmore · InnoVusion

Cameras & computer vision

light · PROPHESEE · DEEP VISION · DEEPSCALE

V2X Systems

commsignia · SAVARI · Cohda Wireless · Autotalks

Data & Simulation

parallel domain · scale · Mighty AI · RIGHTHOOK · cognata

Radar

LUNEWAVE · ECHODYNE · arbe ROBOTICS · OCULII · METAWAVE

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A MUCH MORE HETEROGENOUS BATTERY MARKET

DESCRIPTION

The current market for batteries is dominated by NMC (Nickel, Manganese, Cobalt) and LFP (Lithium Iron Phosphate) chemistry. Batteries with different chemical compositions offer different performance features (e.g., faster charging… slower degradation, lower cost, lower discharge, etc). These are not minor considerations. In the electric mobility world, brands do not compete on horsepower, rather they differentiate themselves based on their battery chemistry and the resulting characteristics impacting performance.

Although NMC and LFP currently dominate the battery chemistry market, this is expected to change. As players in the market invest more money in R&D, new chemistries are predicted to emerge. The ultimate goal could be to achieve commercially viable solid-state batteries. In the meantime, OEMs will use the various alternatives to manufacture vehicles with different sales propositions to suit different consumer preferences and demand in different regions (e.g., weather can affect battery performance, in particular, the range).

RELATED MACRO TRENDS

- CLIMATE CRISIS
- DECARBONIZATION

YEARS TRACKED

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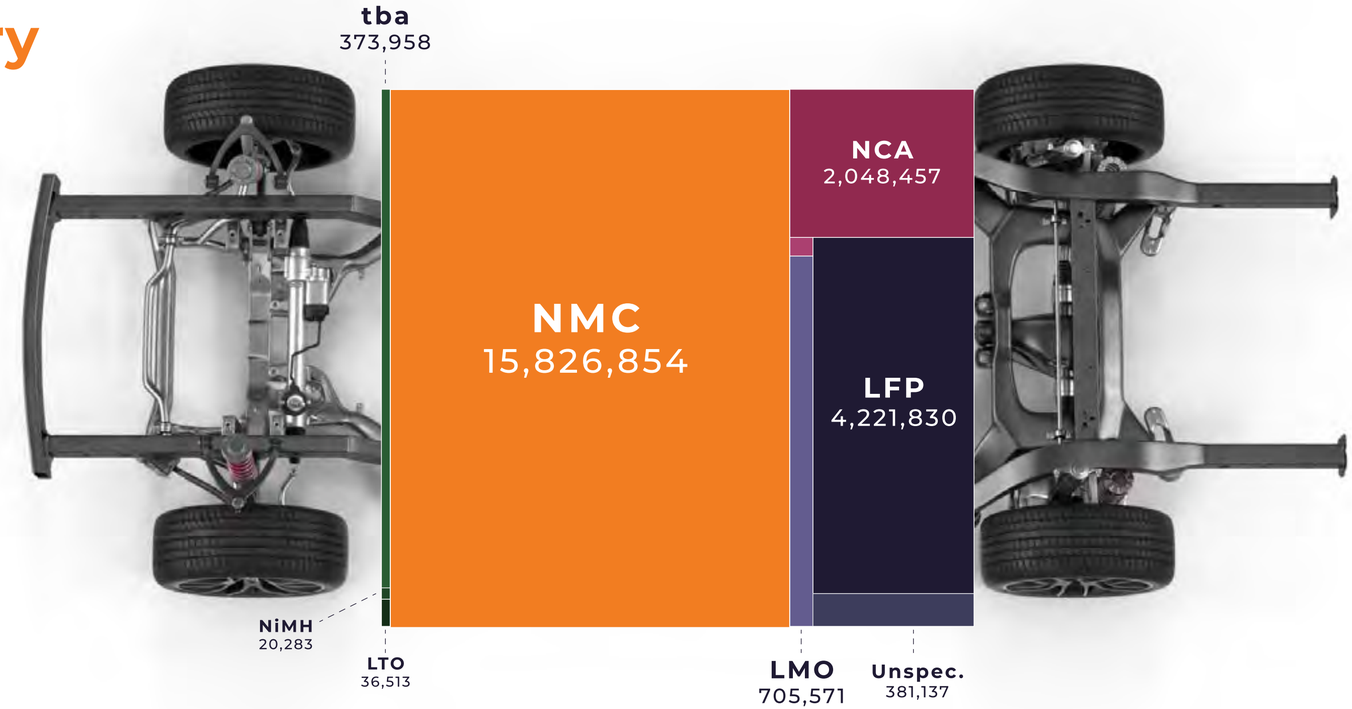
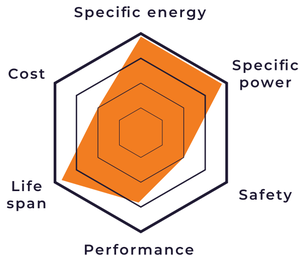
Poputar Li-Ion Battery Chemisries



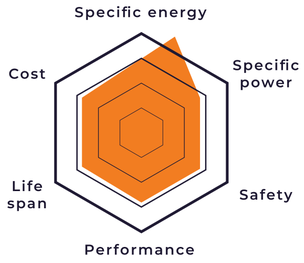
NCA

Lithium-Nickel-Cobalt-Aluminium



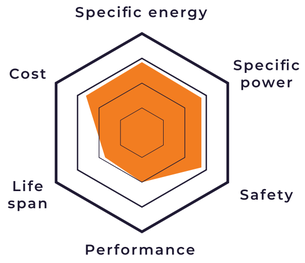
NMC

Lithium-Nickel-Manganese-Cobalt



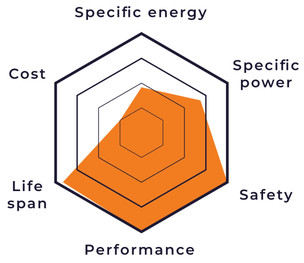
LMO

Lithium-Manganese spinel



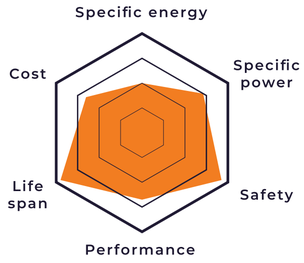
LTO

Lithium-Titanate



LFP

Lithium-Iron phosphate



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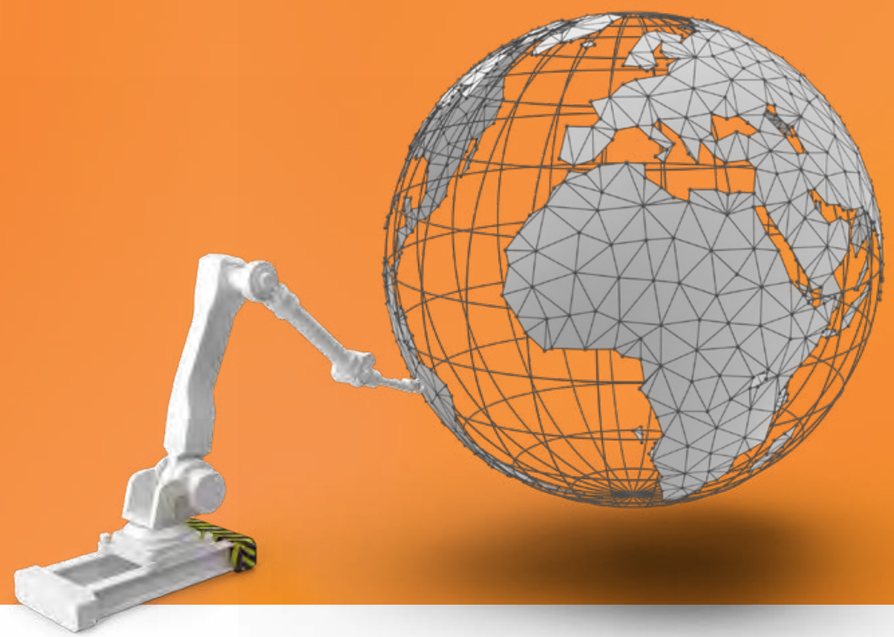
THE GEOPOLITICS OF MOBILITY

DESCRIPTION

Geopolitical mobility is nothing new. However, we are now in the midst of configuring a new paradigm: electric hyper-technological vehicles. The industry is highly intensive and demanding in terms of certain minerals (such as cobalt, lithium, rare earths minerals) and components (chips and semiconductors). Those minerals, and other elements can only be mined in a handful of countries and solely handled by by a handful of companies **(for example, ASML is the sole global supplier of extreme ultraviolet lithography (EUV) photolithography machines used to manufacture the most advanced chips. In fact, Huawei recently, patented a new method to develop EUV lithography to develop microchips)**. [🔗] The transition to a clean industry (looking not just at the vehicles themselves but also at how we produce the energy) is demanding the very same raw materials.

A number of countries and international organizations are adopting different strategies to guarantee the supply of these much needed raw materials. These materials are crucial for building wind turbines, sensors, and electric vehicles (and all components needed for a clean industry transition). For example, in Europe, EU Horizon program participants will categorize rare earth elements by geographic location, quantities, chemical compositions, ramp-up scenarios, prices, and ethical and sustainability indicators, as orchestrated. The objective is to consider all value streams from primary raw to secondary materials. By contrast, Japan is following a different path by financing start-ups that conduct R+D+I projects to create engines that can operate without requiring these elements, thus reducing their dependency on Chinese exports. In China, **backed by political institutions,** [🔗] OEMs are securing their lithium supplies even if that means buying companies or acquiring stakes in mining firms.

Lithium is a key component in all things electronic and it can only be sourced in certain parts of the world (the most important reserves are located in the Lithium triangle; an area on the borders between Chile, Bolivia, and Argentina. It is estimated that 85% of all known lithium reserves can be found there).



RELATED MACRO TRENDS

- **DECARBONIZATION**
- **REDEFINING GLOBALIZATION**

YEARS TRACKED

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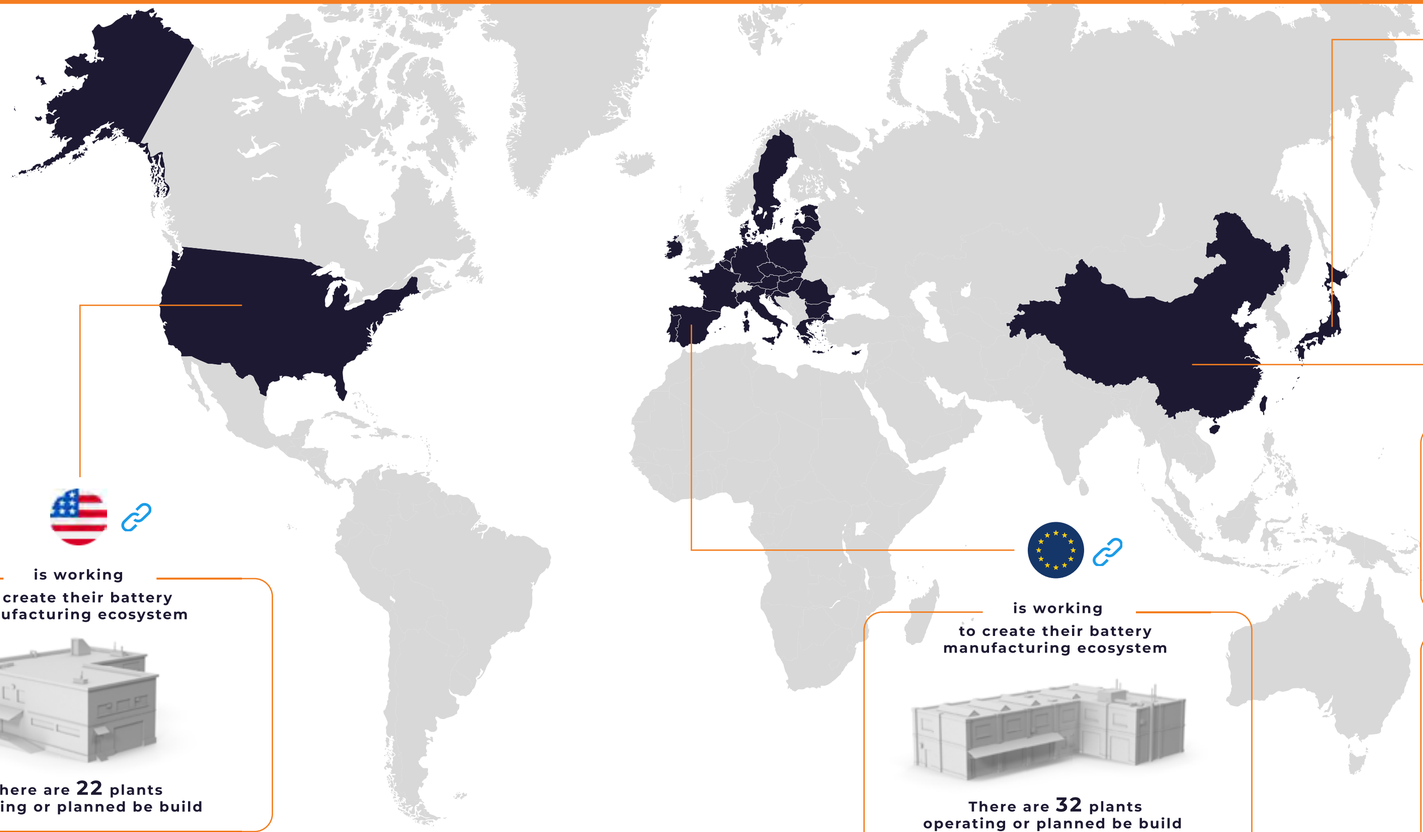
Meanwhile, if we consider chips, the other key element for the future of many industries, we see that they represent a key part of China's strategic plans to become the behemoth of AI, as well as to be able to manufacture thousands of industrial products (including vehicles)). The ban on semiconductor exports to China imposed by the **Biden administration earlier this year is maybe the most important geopolitical political move.** China urgently needs to import chips if it is to become the world leader in advanced technologies. All new and advanced mobility initiatives (drones, autonomous vehicles, xEV, connected vehicles, Twin cities, etc) are highly intensive in their chip use. For example, the average ICE vehicle has 300 chips, but the average xEV has 3,000. China is the world's largest EV manufacturer.

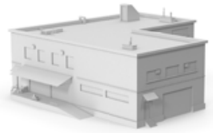
Geopolitically securing the raw material supply chain

Future industries taking shape

Following closely from the above entry, a new analysis from Axios shows how the USA is creating new manufacture belts across the country. In this case, they delve into the new BEV manufacturing belts that are emerging countrywide. The initial impulse to develop a holistic supply chain to manufacture BEVs is going to be boosted by the climate bill President Biden signed into law this week. It will open up tens of billions of dollars in subsidies for high-tech electric vehicle plants across the South and the Midwest.



is working
to create their battery manufacturing ecosystem



There are **22** plants operating or planned be build

to pour money
into non-china rare-earth projects

Control of

80%	77%	60%
World's raw material refining	World's cell capacity	World's component manufacturing

is working
to create their battery manufacturing ecosystem

There are **32** plants operating or planned be build

Spend importing in 2021

$423.9 billion
Chips

$257.3 billion
Oil

AFFORDABLE URBAN EVs MICROCARS

DESCRIPTION

A very important list of factors are driving the affordable urban EV trend. Economic inflation, uncertainty regarding new city mobility schemes (such us LEZ), supply chain problems, increase in the cost of raw materials (such as lithium and the consequent rise in battery prices) people embracing more efficient types of mobility and assets, the on-going growth of urbanization and the fact that space on our planet is becoming ever more scarce ... Bearing in mind all these factors, manufacturers are in a race to launch affordable microcars. Microcars are better suited to our cities, represent the perfect solution for most of our daily commuting, require fewer raw materials, and have sufficient range even without an enormous battery pack.

This trend is being embraced by all kind of players: from start-ups to traditional OEMs around the world. Interestingly, this trend goes against one of the major indicators in the market: the fact that most pure EVs sold are SUVs, and car makers plan to keep launching SUVs. In recent years, we have seen how, for example, the **Tesla Model Y lost its position as the most-sold car model in the EU for the first time in 18 months in favor of the Fiat 500e.** [🔗] The confluence of factors mentioned above has pushed the average price of vehicles up, and EVs continue to be more expensive than their ICE counterparts. Indeed, the factors listed mainly fall outside the control of OEMs, choosing which model to launch and whether to push ahead with smaller or larger cars is very much within their remit.

Offering products that are good enough to suit our needs is the way in which many companies have successfully disrupted a whole variety of industries, where the incumbents were distracted by their focus on launching bigger, better, more expensive products.

That is the key tenet of the thesis written by Clay Christensen in 1997 in his book "The Innovator Dilemma", arguably one of the most important business books of the last decades.

Just look at how e-bikes and e-scooters have disrupted mobility. If we compare them with cars, they are far worse in terms of performance, less convenient in the event of inclement weather, and have less space for transporting goods... but they have increased their presence in cities to an extraordinary level. In other words, the vehicles themselves are actually less comfortable, wit less features, but they are good enough.

RELATED MACRO TRENDS

- DECARBONIZATION
- URBANIZATION

YEARS TRACKED

1

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SIGNALS

In 2015, researchers at Harvard Business School investigated whether Tesla (possibly the most innovative car brand in many customers' minds) offered a truly disruptive model for transportation. Their conclusion: a "souped-up golf cart"—not a Tesla—offered the most transformative potential. The researchers explained that although Tesla is regarded by many as an innovator, ultimately it offers bigger, better-performance vehicles but its cars are not truly disruptive, because at the end they offer a car. An electric car, full of technological features; but at the end is a car. It is not something different.

Nevertheless, the fact that microcars are becoming a force to be reckoned with means that Tesla itself is coming up with a plan to launch a small-sized vehicle that will be perfect for urban environments, and its car will be sold for less than $12,500.

m-cro

receive more than

35,000

pre-reservations

If interest in minimobility rises, and if regulators push this mobility option, this segment could reach

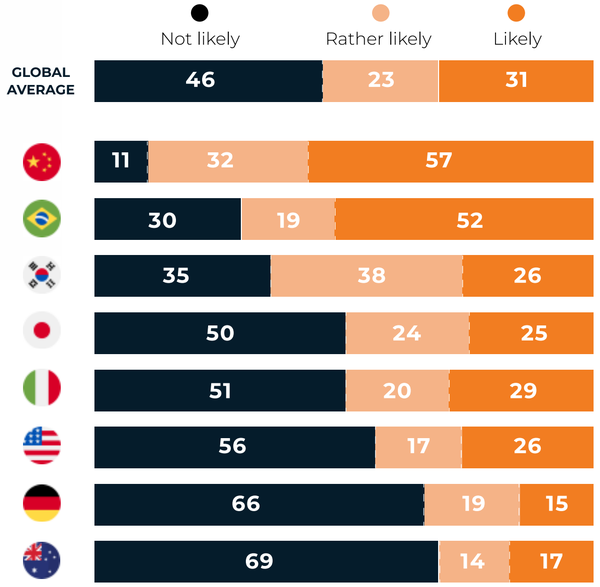
a total addressable market of

$100 billion annually

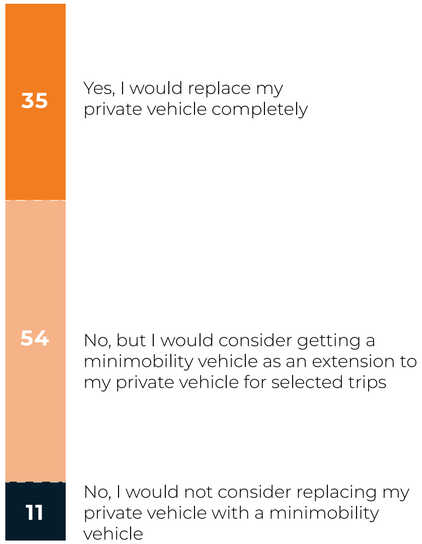
across China, Europe, and North America by 2030

More than **30% of surveyed global consumers** would use a minimobility vehicle in their future mobility mix

Consideration of micromobility usage and implied private-vehicle replacement,[1] % of respondents



Consideration of private vehicle replacement globally,[2] % of respondents



[1] Question: How likelly are you to consider using a minimobility vehicle as part of your future mobility mix?

[2] Question: Would you consider eventually replacing your private vehicle entirely with a minimobility vehicle?

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HUMAN MACHINE INTERFACE (HMI) REDESIGN

DESCRIPTION

Screens in more recent vehicle models are getting bigger and thinner to support the connectivity needs of the driver and passengers (most are now 15 inches minimum and some even span pillar to pillar). If you travel in a modern car today, you may notice curved displays and multiple screens across the center console and elsewhere (e.g., : BMW's new I7 saloon car has the biggest entertainment screen out of any vehicle today).

What's more, small 3D projections are a modern element found in some car interiors. Hi-tech holographic systems may also offer gesture control in the future.

The in-cabin digital assistants of today are voice-enabled; some don't even require a word to wake up, and some have facial recognition capabilities. Future applications may offer improved proactive suggestions and improved assistant responsiveness for the driver and passengers. Through OTA (Over The Air) technology, new features can be enabled and software upgrades can be loaded.

Driver attention will be diverted to varying degrees by activities other than driving whilst they are in the car. Road safety depends on the UX (User Experience) of the feature incorporating touch, voice, image, and other multi-type interactions, and flexibly combining the input forms according to the different use scenarios. It will likely also be appropriate to retain some physical buttons in order to provide users with an intuitive user experience.

Driver attention is critical as we all know. An empirical study conducted by Swedish auto magazine Vi Bilägare requested drivers to perform a series of simple tasks (e.g., changing the radio station and adjusting the climate control) at a speed of 110 Km/h using both digital and physical HMIs. In the worst-performing car, (the MG Marvel R with a digital interface) drivers required 1,400 meters to perform certain tasks, compared to drivers of the best-performing car (the Volvo V70 with physical buttons), who needed only 300 meters.
This does not mean that digital screens have no place in our cars, but rather that screens may need to coexist with physical buttons; and, even more importantly, when introduced, they must be implemented with a perfect UX.

Here we also consider the redesign of how drivers interact with ADAS (Advanced Sriver Assistance System) systems. They are very useful and could even save lives. But right now, many drivers consider them sufficiently annoying they opt to disable them. That makes them a waste of hardware and software, and ultimately a waste of safety mechanisms.

RELATED MACRO TRENDS

- DATA & CONNECTIVITY
- AI & ROBOTICS

YEARS TRACKED

2

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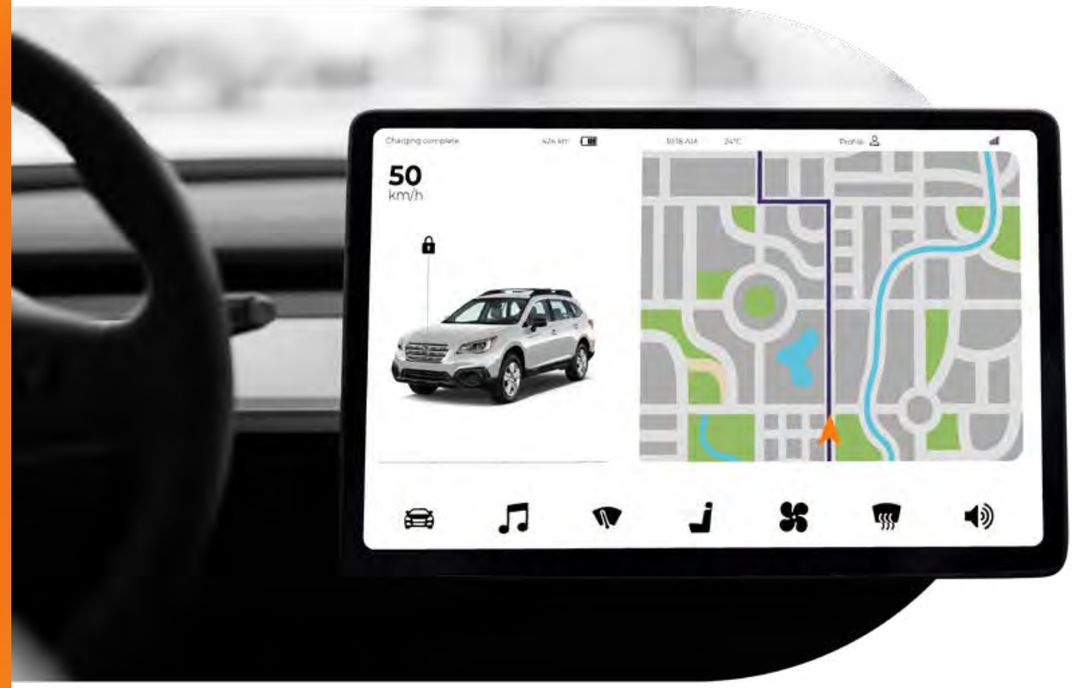
SIGNALS

AppleCar Play

Volvo photorealistic graphics

Toyota voice



Physical buttons outperform touchscreens in new cars,

test finds In the worst-performing car (the MG Marvel R, with a digital interface), drivers required 1,400 meters to perform certain tasks, compared to drivers of the best-performing car (the Volvo V70 with physical buttons), who needed only 300 meters. A response difference of 1,100 meters, could mean the difference between life and death.

Many have a complicated perception of ADAS and its benefits

In fact, as many as 70% of drivers even disable them. The reasons behind this vary, ranging from a belief that features were not working properly (41 percent), to finding the noises/lights distracting (41 percent), to feeling that the technology was not needed (30 percent).

On average, 23% of customers with these systems

complain that the alerts are annoying or bothersome

The “tune out driving” effect.

Early findings from a study that is looking into distracted driving in semi-automatic vehicles reveals that people aren’t always fully paying attention. “The system gives you the sense of false security,” he said. “You feel like the system is in full control of driving while it’s not.”

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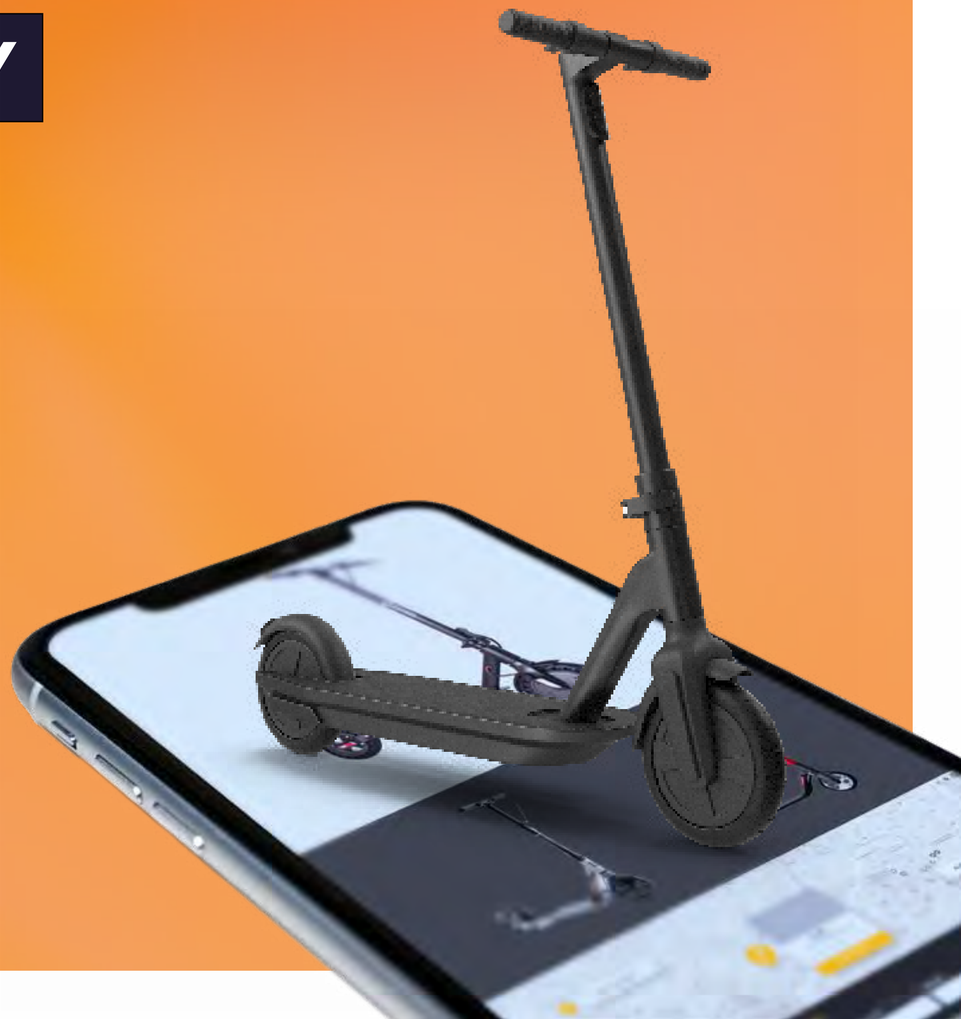
FROM SHARED TO SUBSCRIPTION & OWNERSHIP IN MICROMOBILITY

DESCRIPTION

Since the dawn of shared mobility (be it cars, bikes, motorcycles, or scooters), services have changed the face of our cities forever. They have also altered mobility schemes and user behavior. Users have been able to test assets on short trips that they may never have had the chance to do otherwise had they needed to buy them. After testing these vehicles through shared systems, many users have decided to access them in a more convenient way (be it through ownership or subscription).

The reason: sharing systems is expensive for daily use and are useless when you need to access an asset quickly. There is nothing more frustrating than opening the App, only to find there are no assets nearby or available. This major limitation of the shared model is favouring asset access through sales and subscription platforms.



RELATED MACRO TRENDS

- NEW BUSINESS MODELS
- URBANIZATION
- DECARBONIZATION

YEARS TRACKED

1

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SIGNALS

Willing to use e-kickscooters for their commute, most 64 % said that they would prefer private ownership. Another 23 % preferred either operational leasing or subscription.

Imagine using an e-kickscooter for everyday commute to work. What are your main reasons for purchasing an e-kickscooter?

Privately owned

- 64 — Buy own e-kickscooter
- 12 — Operational leasing
- 11 — Subscription based

Shared usage

- 7 — Peer to peer sharing
- 6 — Shared (station based or free floating)

What are your main reasons for purchasing an e- kickscooter?

- 33 — Prefer not to share vehicle with others
- 32 — Value flexibility to carry vehicle on subway/ bus
- 22 — Tried shared version and decided to buy one

Although ownership and sharing are the bigger market today **subscription** have a higher **CARG** in the **micromobility category**

	Ownership	Subscription	Sharing
	35€	<1€	5€
	30€	<1€	<1€
	<1€	<1€	2€
	15€	<1€	<1€

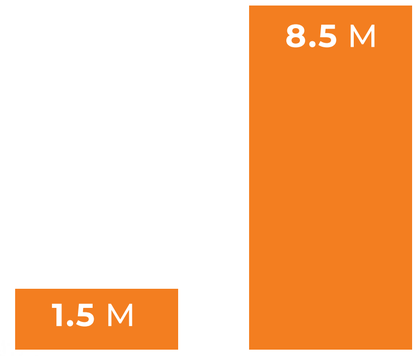
Projected CAGR, 2021-2030

Moderate <10% · High 10%-30% · Hyper >30%

SEGWAY

Simply moving

Segway, one of the largest scooter manufacturers in the world, reported in May that it had produced a total of :



May

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AUTOMOTIVE CYBER SECURITY

DESCRIPTION

Automakers are only too aware of the critical need for automotive cybersecurity. Security standards inside the industry must be enhanced as cybercriminals target it more frequently and aggressively.

Improved security procedures must be implemented during the manufacturing processes, supply chain and distribution, as well as in connected vehicles and telematics systems. If not, millions of dollars of damage may be caused and human lives may be placed in danger (e.g., Ethical hacker Sam Curry´s findings that he is able to hack vehicles manufactured by Honda and Nissan knowing only the Vehicle Identification Number (VIN).

According to McKinsey & Company, [🔗] cars today have about 100 million lines of code embedded in them. That figure is predicted to triple by 2030. A conventional PC operating system may have up to 40 million lines of code, whilst an airplane has roughly 15 million lines. The danger of cyberattacks in the value chain increases with machine complexity. But lines are just that: lines. The quality and type of data gathered by our vehicles are very relevant. They contain or will soon contain our names, credit card details, geospatial data (position and timestamp)... data that is critical for our privacy and that could damage both individuals and companies in dreadful ways in the event of information leaks.

The automotive sector must take a number of actions to stop them and reduce their impact. If OEMs and startups are able to better secure their manufacturing processes, connected cars and whole fleets, they will be better positioned to handle these attacks and increase the security of all vehicle features.

RELATED MACRO TRENDS

✳ **TRANSPARENCY & SECURITY**

YEARS TRACKED

2

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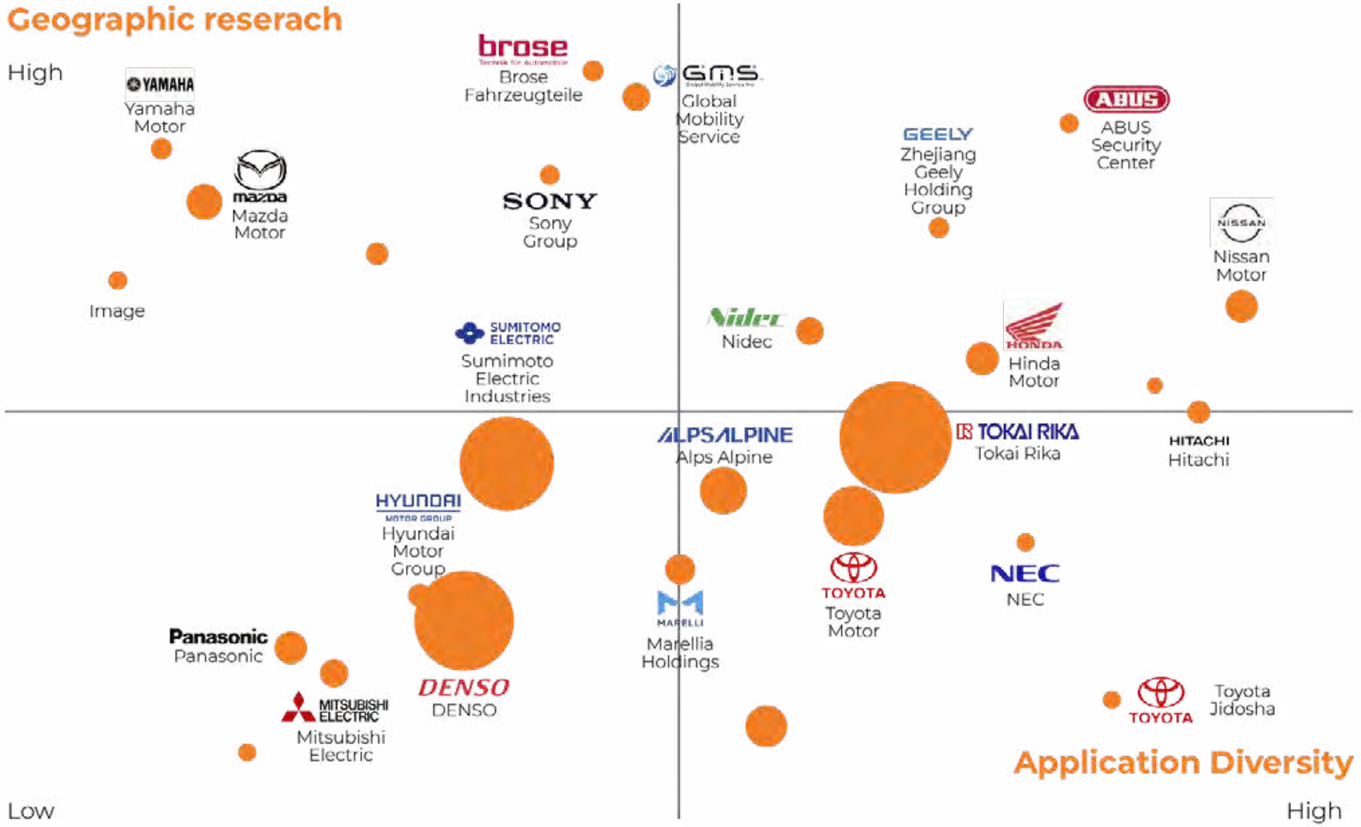
SIGNALS

Key players in vehicle anti-thef system

a disruptive innovation in the automotive industry



· Bubble size = patent volumes between 2010 and 2021

· "Application diversity" and "geographic reserach" are normalised and ranked on a scale between 0 and 1.

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SIGNALS

Sam Curry

NIO suffers user **data breach**, hacker demands $2.25 million worth of bitcoin

Toyota suspends production at car plants as **cyberattack hits key supplier**

Car Parts Giant Denso **Targeted by Ransomware Group**

Phoenix-area title loan, MVD provider confirms **data breach**

Arnold Clark hit by Christmas Eve **'cyber attack' leaving staff unable to access systems**

Communauto car-sharing service **victim of a cyber attack**

Pendragon being held to $60m ransom by **dark web hackers**

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MOBILITY POLLUTION CONCERNS DIVERSIFY

DESCRIPTION

Until now, whenever we think about mobility related pollution, a clear image springs to mind: CO_2 emissions from petrol and diesel vehicles. But, this is set to change. CO_2 will be just one of several pollution factors; probably the most important and the most extensive, but not the only one.

Vehicles pollute the air in three ways: gas, acoustic, and microplastic emissions.

At the global level, the transport sector is responsible for **16%** [🔗] of all emissions globally; with that figure rising to almost **30%** in certain regions such as the **EU.** [🔗] In the EU, 21% of all emissions are attributed to ground transportation. In Spain, the National Health School estimates that pollution has caused **93,000 premature deaths** [🔗] in the last decade.

At an acoustic level, we are all aware of transport noise and we live with it. But we do not usually notice how important it is for our environment or our health. It is only when we leave the city and are surrounded by nature, in a quiet place, that we realize the sense of inner peace that noise free spaces bring. For example, one study found that residents of Paris and the surrounding suburbs lose “more than three years of healthy life”, on average, due to the health impacts of sonic disturbances caused primarily by automobiles.

Finally, microplastics are something that we have all heard a lot about lately, but their connection with the world of mobility has not been talked about much. It turns out that each of us consumes an average of 5g of plastic in microform per week, which is equivalent to **one credit card per week.** [🔗] Moreover, **28%** of the microplastics in our oceans are molecules from vehicle wheels that come off due to friction.

RELATED MACRO TRENDS

- **DECARBONIZATION**
- **CLIMATE CRISIS**
- **URBANIZATION**

YEARS TRACKED

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SIGNALS

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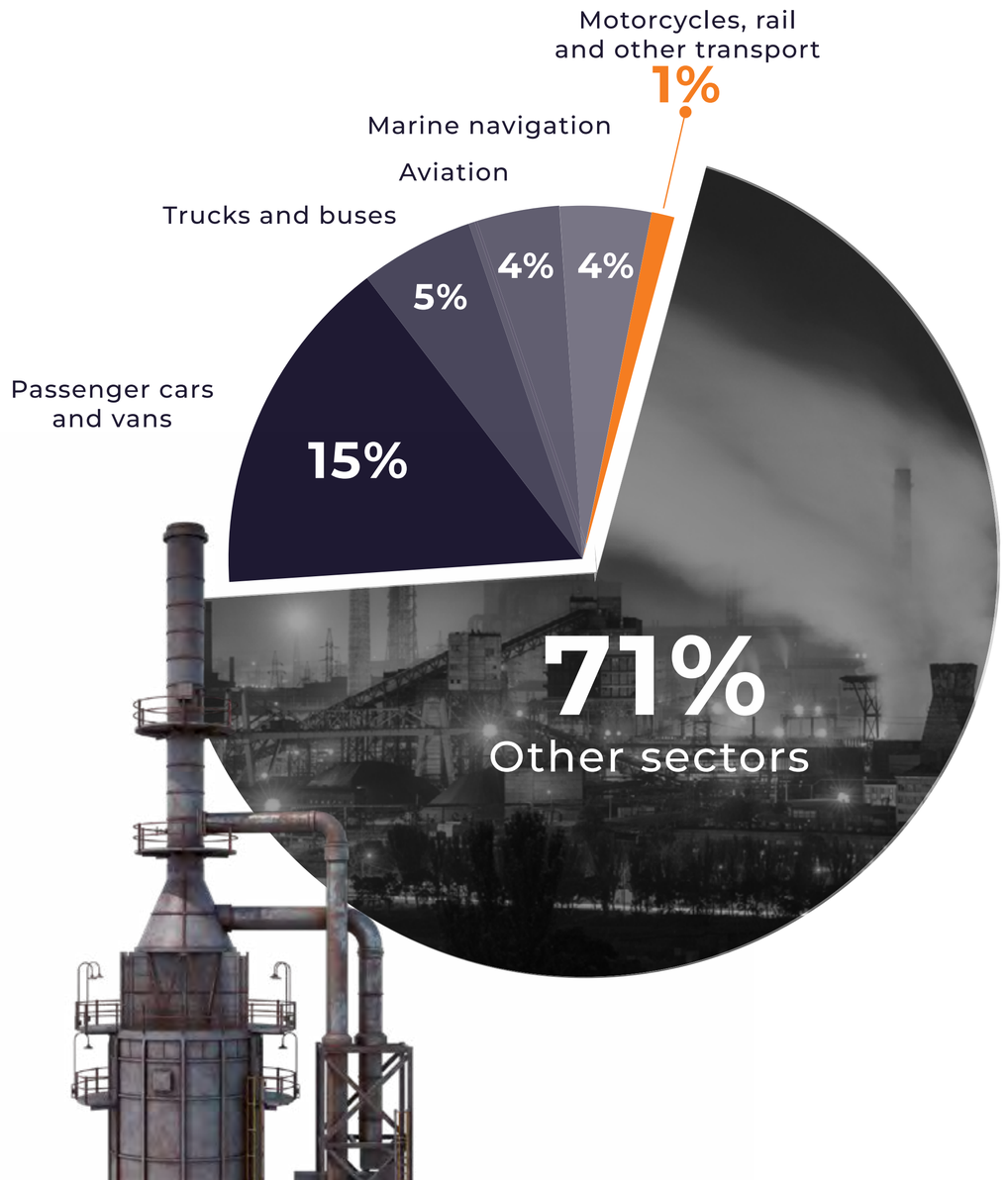
Greenhouse gas emissions in the EU

2018 total: 3.8 GT CO_2e



Did you know?

As much as **28%** of microplastics in the ocean caomes from tires shedding synthetic rubber as they wear down

In the EU

12,000

Premature deaths caused by long-term exposure to environmental noise

22 million

People suffer chronic high annoyance

12,500

Schoolchildren suffer learning impairment in school caused by aircraft noise

THE YEAR FOR BATTERY RECYCLING

DESCRIPTION

The rise of a society powered by batteries is changing the face of our businesses, cities, homes, and lives. Right now, consumers rely on batteries for almost everything: tracking their exercise regimes (through smartphone Apps such as Strava), health (battery-powered smart rings), guiding us on our roads (through navigations Apps), backing up the grid power in our homes (typically using vehicles batteries to give them a second life), powering our vehicles and so on. Well, the same principle could be applied to other raw materials. Take, for example, the rare earth ore graphite. That element is essential for creating magnets for EVs motors and for building aero generators.

Our economy is already hyper-dependent on minerals that we extract from the earth, and will become increasingly more so. **This reality is especially harmful for the transition to a green economy which** [🔗] is based on creating a series of products and machinery that are very demanding in terms of minerals. On many occasions, different products require the same, or very similar, minerals.

There are widespread concerns about whether we have enough materials on Earth to supply this transition and even whether or not we can mine them fast enough to supply the demand for such transition. For instance, in the case of **lithium,** [🔗] estimates suggest that we do have enough to support the transition to EVs; but that, currently, we are not producing enough to keep up with demand (that could result in a major bottleneck this decade).

For these reasons, during 2022, we saw an explosion in the number of venture capital financing start-ups specialising in battery recycling. And we think we can expect to see these companies continue to grow over the next few years.

RELATED MACRO TRENDS

- **CIRCULAR & REGENERATIVE SYSTEMS**
- **DECARBONIZATION**
- **NEW BUSINESS MODELS**

YEARS TRACKED

1

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SIGNALS

REDWOOD MATERIALS

Redwood Materials, one of the battery recycling industry's dominant players **that have raised to date $775M**, has said he worries the company is too late to meet demand

About **15 million tons of lithium-ion batteries** are expected to retire by 2030

Recent research has shown that by 2050 recycled materials could supply used in the United States

45–52% cobalt **22–27%** lithium **40–46%** nickel

Advancements in technologies and techniques in the battery proces have lead to n increase in the material recovery. New techniques such as hydrometallurgy is allowing different players to recover the **95%–98% of the materials**

LG Ford NIO

Have invested during this year in battery recycle startups

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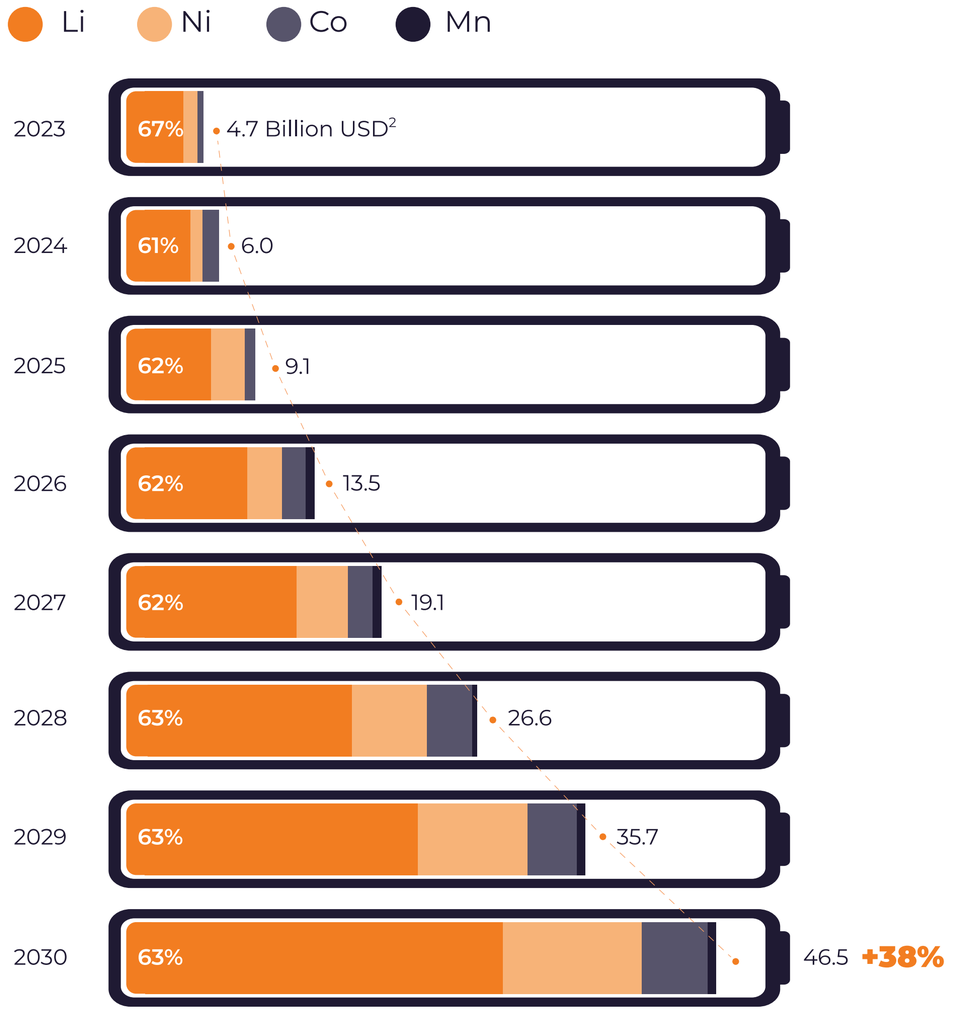
Global EV Battery recycling market size prospects

The development of the market is about to accelerate, wich in expected to exceed **10 billion dollars** in the next 5 years



BLOCKCHAIN IN THE AUTOMOTIVE INDUSTRY

DESCRIPTION

The use of blockchain ("a distributed database that maintains a continuously growing list of ordered records, called blocks". In simple word a technologies that among other things works as a digital notary) as a tracking technology is spreading across the automotive industry. Vehicles are no longer going to be just a means of transportation and blockchain is going to play an important role in the upcoming technological revolution.

According to Frost and Sullivan, the increasing use of blockchain technology is going to be accompanied by continuous advancements in the automotive industry, specifically involving digitization and automation. Tech companies and start-ups focused on blockchain technology are building the infrastructure to drive the technology's complex impact: major trends, such as parts authentication, asset tracking, modern logistics systems, and the proliferation of financial technology (fintech) are expected to drive the adoption of blockchain technology in the aftermarket industry.

The main benefits of using blockchain in the aftermarket include greater transparency of ownership, pricing and smart contracts. Blockchain is expected to speed up payments through e-wallets, improve security and eliminate fraud through transparent blocks, as well as eliminate middlemen, reduce paperwork and simplify supply chains.

Within the world of Blockchain, we find that NFTs (also known as Non-Fungible tokensor tokens that can be redeemed because they have important information that could be consumed in future occasions) are being utilized strategically by many automotive makers. The most well known include Chevrolet's collaboration with an artist named Nick Sullo to auction a 2023 Corvette Z06 NFT and Porsche Australia´s Taycan NFT collaboration with artist Nigel Sense to celebrate 70 years of the German brand´s presence in Australia.

Several research websites, such as **MarketsAndMarkets,** [🔗] estimate that blockchain technology will grow from $0.35Bn in 2020 to $5.29Bn by 2030 with a huge impact on the automotive industry.

The most significant technological advancements of the 20th century are typically credited to the automobile sector. However, the industry is now encountering a lot of difficulties when it comes to advertising, marketing, insuring, and recalling its vehicles and their parts. By giving vehicle businesses and their partners a trustworthy and transparent tool to gather, store, manage, and use automobile data more effectively, blockchain technology is already demonstrating that it can provide a solution to most of those problems.

RELATED MACRO TRENDS

- **WEB3**
- **TRANSPARENCY & SECURITY**
- **DATA & CONNECTIVITY**
- **NEW BUSINESS MODELS**

YEARS TRACKED

1

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SIGNALS

Polestar

Polestar 2 gets upgrades to
design, range, and sustainability
thanks to blockchain technology

OTONOMI

Insurtech Otonomi Raises $3.4M to Build a First-to-Market
Blockchain-Powered Parametric Cargo Platform

Estonian crypto exchange
Coinmetro garners **€7 million**

PORSCHE

LAMBORGHINI

CUBE AMO DAV Gem KornChain

BIGCHAIN DB CARVERTICAL loyyal THE AUTO BLOCK

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AR, VR, METAVERSE AND MOBILITY

DESCRIPTION

The metaverse (digital words that interact with the physical word and could even replace it in some occasions. i.e., a virtual dealership in where people could go through all the purchase journey of buying a vehicle) and how it will affect our lives has been the subject of a lot of writing over the past year. The smartphone, which is nothing more than a small display packed with a multitude of processors in our pockets, and the current technological period, which feeds on human-technology interaction, are set to be replaced by the metaverse.

Every aspect of the auto industry, including manufacturing, product customization, community, and brand loyalty, are likely to be impacted by the metaverse. The new technologies will also open up a wide range of fresh options for the physical and digital worlds to merge. Although the fully-fledged metaverse is not likely to emerge for at least five to ten years, stakeholders in the mobility sector can already earn significant financial benefits from spatial computing and extended reality (including AR -Augmented Reality-, VR -Virtual Reality-, and MR- Mixed Reality-). These preliminary efforts to connect the real and virtual worlds could develop into more immersive experiences. Consumers might be able to explore an extremely accurate duplicate of a vehicle—opening its doors, feeling its seats, and accelerating onto a highway—just as they would in an actual car, thanks to advancements in XR and the introduction of haptic devices, which imitate the touch sensation.

It is important to differentiate between the aforementioned three technologies. AR is much more mature in its development and has also already had much more of an impact on the current value chain of the mobility industry. Although VR and the metaverses have the potential to significantly impact several parts of the value chain (for example in sales), they also have the capacity to create a new part of the value chain, hereto inaccessible for the industry. These new steps in the value chain are expected to grow **from $1.9 billion in 2022 to $16.5 billion by 2030.** [🔗]

RELATED MACRO TRENDS

- **WEB3**
- **TRANSPARENCY & SECURITY**
- **DATA & CONNECTIVITY**
- **NEW BUSINESS MODELS**

YEARS TRACKED

1

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SIGNALS

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	Marketing	Infotainment	Navigation	Maintenance	Manufacture
AR	Threedium develop 3D mobility assets for ecommece that can be watch with AR apps by customers.	Audi Incumbents such us Audi has AR HUDs displays in some models. Or Startups such as Wayraydevelops aftermarket	CYVISION Sygic PHIAR Cyvision, Sygi or Phiar develops AR navigation or GPS apps.	DIGITAL AGENTS INTERACTIVE TRADIEBOT Mercedes-Benz Digital Agents, Tradiebot or Mercedes technicians use AR apps to repair the vehicles	
VR	vroom TOYOTA Audi have used VR set to create virtual reality showrooms	Audi Audi investing and using Holoride to create in vehicle virtual reality entertainment.			
METAVERSE	HYUNDAI Hyundai used Roblox to launch the Hyundai Mobility Adventure / Hyundai VENUE N Line becomes the first car in Hyundai India's model range to be launched on Metaverse Mercedes-Benz Mercedes Benz teamed up with international crypto artist collective, ART2PEOPLE, for its first non-fungible token (NFT) art project, dubbed NF-G MG MG Motors Showcases Metaverse To Offer Immersive Experience RENAULT The Sandbox partners with Renault Korea to offer digital automotive experiences in the metaverse VOLVO Volvo Cars has made history in India, becoming the first luxury auto brand to reveal a car in the metaverse, known locally as the 'Volvoverse'. Volvo created a virtual launch of the Volvo XC40 Recharge Ferrari Ferrari partners with Fornite to license the use of the car brand sin the video game				BMW The BMW Group and NVIDIA are generating a completely new approach to planning highly complex manufacturing systems with the Omniverse platform

SIGNALS

The metaverse:
Driving value in the mobility sector

The future of mobility in the metaverse
is not (only) what you imagine

Mobility in the metaverse
How technology may shape our experience of the city

Hologractor Metaverse on wheels

How will the metaverse
shape the future of the automotive industry?

What Happens **When A Car Enters The Metaverse?**

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CARBON NEUTRAL
CIRCULAR ECONOMY

RELATED
MACRO TRENDS

YEARS TRACKED

DESCRIPTION

Circular economy is defined as a new paradigm that aims to minimize waste and pollution during all the value chain of a given industry. It focus on recycling, re-tiling materials and increase the lifespan of products through repair and retrofit them. It also includes the use of sustainable materials into the value chain (i.e., use of pineapples waste to create a material that substitute real leather).

The current climate change crisis is impacting several industries, including the automotive sector, which has been one of the most villainized, even though mobility as a whole accounts for no more than 30% of CO_2 emissions globally, on average. For a while now, the industry has been focused on developing electric and hydrogen vehicles that use new energies. This is a part of the global picture, which in the mobility industry means changing the energy we use to move around, creating circular value chains for the materials we use, increasing the lifetime of vehicles and their components, and increasing the use rates of our mobility assets.

The industry is working hard on all four fronts. All eyes are focused on the transition to electric mobility, it is by far the most publicised beyond the transport industry. There are however plenty of other examples involving material circularity (the recycling and reuse of materials, the mining of new raw materials from renewable sources) that seek to increase the lifetime of vehicles and their components and improve the efficiency of the use of assets.

In this context, all the stakeholders of mobility are setting up roadmaps that aim to achieve carbon neutrality, with private companies adapting their plans to comply with policy frameworks developed by government stakeholders (the EU aims to achieve carbon neutrality by 2050 and China by 2060).

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INTELLIGENCE

SIGNALS

By 240 the emission form material production could represent the 60% of the life-cycle emission in the auto industry. But implement measure to decrease the future emission by material production could help to decrease cost in the long terms

Renault announced Europe's first circular economy factory – the Refactory – focused on mobility. It is built around four pillars: Re-trofit (vehicle life extension), Re-energy (green energy management), Re-cycle (resource management optimisation), and Re-start (accessible innovation)

Today, almost 44% of all trucks in North America operate on re-treaded tyres. Re-treading can extend a tyre's life by at least 200%, while helping fleets save $3 billion annually in tyre related costs

The Toyota Mirai, Audi eTron, Ford F-150, and BMW i3V highlight the use of aluminium recycling

Automakers such as General Motors, Honda, Nissan, Ford, Volkswagen, and Chrysler are involved in plastics recycling

Tesla ditched leather upholstery by 2017 (getting rid of leather-wrapped steering wheels took longer). Other EV makers are following suit. The new Rivian R1T [] uses "vegan leather" upholstery exclusively; [GMC's Hummer EV] [] pickup and SUV will have synthetic skins as well. [Volvo's C40 Recharge] [] is leather-free, and by 2030, when its entire line-up is electric, no Volvo will use leather

SIGNALS

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YEAR	Number of EV models	% Of forecast sales EV over the total	% Of of total emissions reductions
2023	BMW 25; Mazda 1; Renault Nissan 8; Ford 40; Daimler 40		
2024		BYD 100%; Aston Martin 20%	
2025	BMW 25; Mazda 3; GM 30; Toyota 15; Hyundai 29; Audi 20	BMW 15-25%; Geely 40%; SAIC 30%; Volvo 50%; Audi 40%; Daimler 25%	Geely -50%
2026	Kia 11		
2030	SAIC 30; VW 70; Honda 30	Volvo 100%; Stellantis 70%; BMW 50%; Mazda 25%; Renault Nissan 40%; Honda 40%; Porsche 8%; Daimler 50%	BMW -20%; Porsche
2035	Daimler 100%; GM 100%; Ford 100%; VW 50%; Toyota 15-20%; Audi 100%	Mazda	
2040	Hyundai 100%; Honda 100%	GM; Ford; VW	
2045	Great Wall; Kia		
2050	Renault Nissan	Toyota	

TRAIN RENAISSANCE

DESCRIPTION

In order to provide a viable alternative to flying, cut transportation emissions, and increase the economy's green factor, Europe needs a more appealing and well-connected railway network. Traditionally, EU Member State Governments and rail operators have prioritized national connections however, outdated infrastructure links make international rail travel a struggle.Investment in rail infrastructure, improved cross-border collaboration, streamlined reservation systems, and equitable taxation across transport modes are all necessary if we are to shift towards more travel by rail and whereby considerably reduce EU transport emissions.

By law, in France, short-haul flights between places that can be reached by train in under 2.5 hours are restricted. This policy is wonderful for the environment and gives travellers the chance to explore some of the nation's most breath-taking train routes.

Meanwhile in Spain among other EU Governments which have established , the Government has established a program to encourage the use of public transportation by absorbing part of the cost of on season and multi-trip passes. The goal of the measure is to encourage residents to regard and use collective public transportation as a more dependable, comfortable, financially viable, and environmentally responsible alternative to driving a private vehicle, whilst also easing the financial burden on citizens during periods of extreme energy and fuel price increases.

By 2030, the European Union wants to double and then triple the use of high-speed rail. It has never been clearer to choose to take the train.

The European Environmental Agency reports, "Train travel remains overall the most environmentally friendly mode of motorised passenger transport in Europe."

According to Statista, [🔗] the train segment in EU is expected to show an annual growth rate (CAGR 2023-2027) of 2.85%, resulting in a projected market volume of US$33.07bn by 2027.

RELATED MACRO TRENDS

- **DECARBONIZATION**
- **CLIMATE CRISIS**

YEARS TRACKED

1

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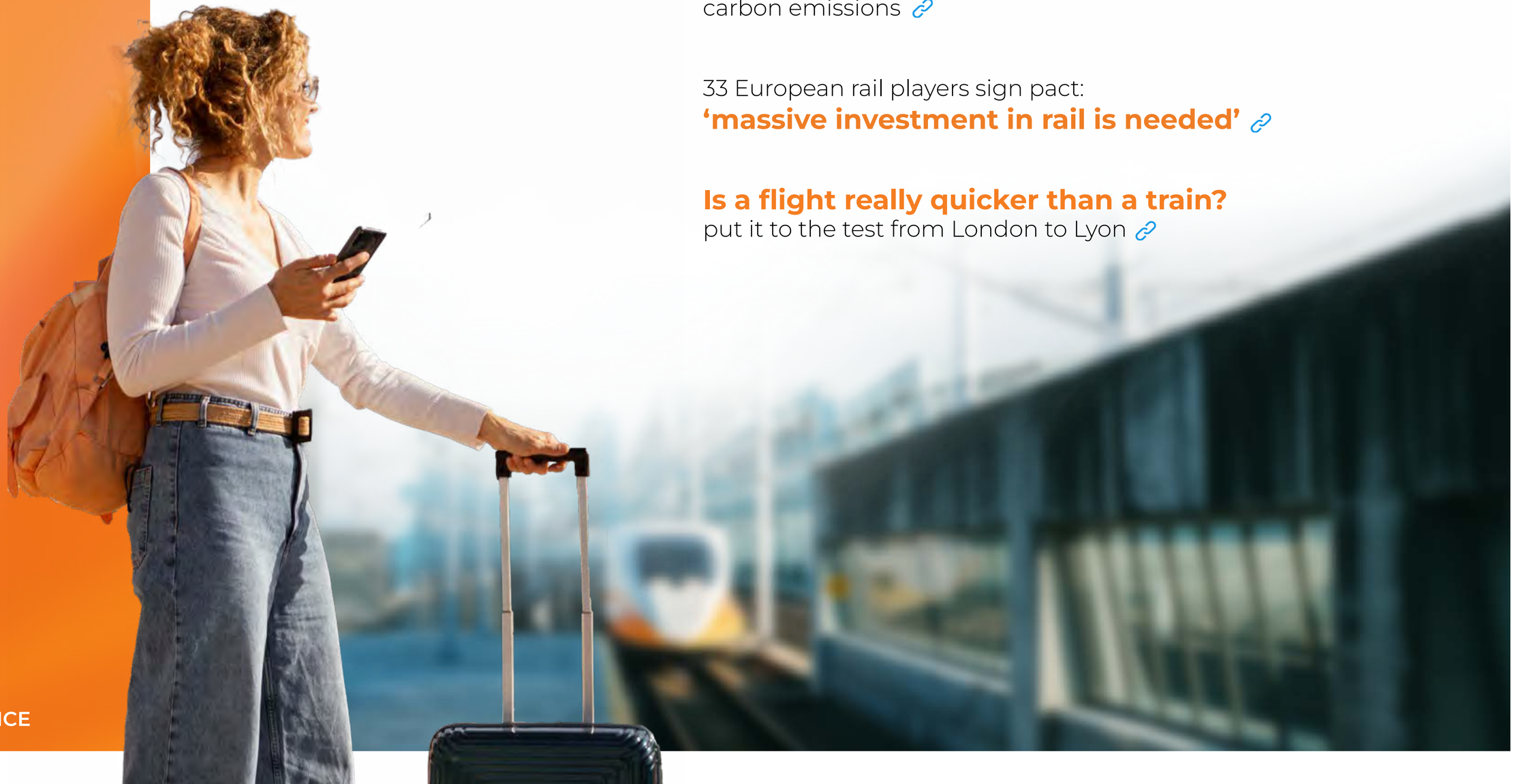
SIGNALS

Spanish government to finance **ticket price reduction** to promote public transport

France **bans domestic flights** in a bid to reduce carbon emissions

33 European rail players sign pact:
‘massive investment in rail is needed’

Is a flight really quicker than a train?
put it to the test from London to Lyon



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LAST MILE ROBOTS GO...

DESCRIPTION

Last-mile robot fever has slowed down in recent months after several large companies, such as Amazon and Fedex, decided to abandon their projects due to inefficiency and the impossibility of meeting customer expectations. Sidewalk delivery robots are cute and cool, but pilot tests in four USA locations (Pittsburgh, Miami-Dade County, Detroit and San Jose), the UAE (United Arab Emirates) and Japan showed that successful deployment requires more than just smart technology.

Nevertheless, many other players continue to invest in this type of initiatives, taking advantage of the excitement that it projects. Examples include: OEMs like Hyundai with its robotaxi specialising in moving objects and smooth driving, delivering food, drinks, and amenities as quickly as human staffers in hotels; companies that are well established in the world of delivery, such as Uber Eats, in its partnership with Cartken; and Grubhub delivering to college campuses with a very positive response from students.

However, the experience of Amazon speaks volumes. As the world´s largest retailer, it is uniquely positioned to make last-mile robots work, but even Amazon has concluded that continuing to invest billions in these kind of project may not be as beneficial as we hoped just a couple of years ago. It is hard to predict how the segment will evolve over the next 5 to 10 years because there are so many moving parts, solutions to put into practice and regulations to consider, define and police.

So, what can we expect from these robots? It looks like deploying them in open urban environments is not being as easiest as it looks. Specially in big dense urban city centers. Instead, they will be let loose in closed environments, such as college campus, big corporate parks or sub-urban environments and perhaps even in small-mid size cities where they will have a positive impact.

RELATED MACRO TRENDS

- AI & ROBOTICS
- DATA & CONNECTIVITY

YEARS TRACKED

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SIGNALS

amazon

Amazon cuts different Last-mile robotics projects

FedEx

Fedex abandoms its last mile delivery

HYUNDAI

Robot to deliver with dexterity by Hyundai

Ottonomy.IO

Ottonomy.IO Unveils Ottobot Yeti Robot for Unattended Deliveries

Uber Eats

Uber Eats, Cartken debut autonomous robot delivery in Miami area

GRUBHUB

Robot Shuttles Now Deliver Grubhub Orders on College Campuses

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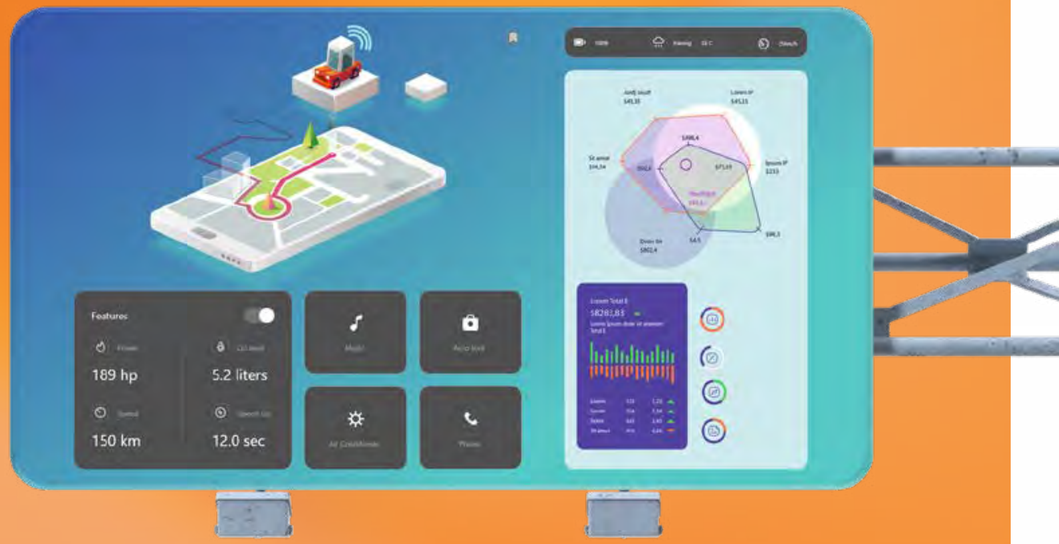
MOBILITY DATA IS GOLD

DESCRIPTION

If data is the new gold, then mobility data is one of its most valuable deposits. As we move around in our daily lives, our devices and credit card transactions are busily creating a detailed data log. This includes all sorts of data about us, such as our origin-destination points, schedules, the places we frequently visit and the activities we enjoy. In the right hands, this data could be used to serve us. In the wrong hands, the consequences are unthinkable.

Another related topic is how companies can ethically introduce people into the mix and offer them incentives to knowingly share their information. This new phenomenon is called “Personal data as a currency”. One example is a new App called Caden where individuals share data about the Apps and services they use in exchange for being subject to advertising. In turn, users receive a percentage of the revenue Caden generates by selling their data to third parties for advertising purposes.

One of the most important facts about the data coming from mobility products and services is that it coud, in fact is being currently used, within the mobility industry. It could be applied to other industries. For example, all the BI (Business Intelligence) using geospatial data for retail industry used this kind of data.



RELATED MACRO TRENDS

- **DATA & CONNECTIVITY**
- **NEW BUSINESS MODELS**

YEARS TRACKED

2

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SIGNALS

It is estimated that **2.5 quintillion bytes of data** are produced every day and by the year 2025, 463 Exabytes of data will be generated daily

Just Connected Car data could deliver **$250 billion to $400 billion** in annual incremental value for players across the ecosystem in 2030. (Mckinsey)

The **location history on your mobile phone** boost and industry that is estimated to worth $12 billion

This New App Wants to **Pay You to Share Your Data** For Advertising

A survey about personal location data fund that the **majority (60%) said they were willing to offer their personal data for free or a price**. Among this group, a majority valued their data at more than $10, with the single largest group saying $20+

The interesting is the potential revenue. It depends a lot on the sociodemographic place the user occupy (country, age, level of income, etc). But the location (coming form their record of the Mobile phone or car) data is worth $55/ year

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CONSOLIDATION OF SHARING MICROMOBILITY

DESCRIPTION

Since Bird first launched its e-scooter sharing business back in 2017, the micromobility asset has been deployed in almost every major city in the world, and the market has evolved rapidly. Its bright beginnings were followed by some much tougher years.

More recently, we have seen cities overwhelmed by the sheer volume of micromobility operators and their mobility assets. This has resulted in blocked sidewalks and vehicles with unprofitable lifespans. In Madrid, for example, more than a dozen shared service operators were competing, offering a wide portfolio of mobility assets from bicycles to e-scooters to mopeds.

Frustratingly, the cost per trip using one of these assets is too high for regular residents to afford in order to use sharing services for their daily commutes. Hence, subscription and ownership services are now gaining momentum within this category, which we expect will gain further traction through M&A (Mergers and acquisitions) activity.

According to McKinsey, people are willing to use micromobility assets as their main commuter vehicle (globally 68% of people say they are but the exact percentages vary by region and age), but most would much rather own or subscribe to their asset of choice than share it.

As a result, we expect to see consolidation of players within the micromobility sharing space. Such a development would make the assets cheaper and less of a hassle to use as it would reduce the likelihood of not being able to find a vehicle on the street when you most need one.

Moreover, most operators are not profitable at this stage. In fact, during 2022, we saw dozens of lay offs, companies closing down operations in the worst performing cities to focus on those that could be profitable.

All of this is creating a perfect environment for future consolidations: mergers, acquisitions, etc.

RELATED MACRO TRENDS

✳ URBANIZATION

YEARS TRACKED

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SIGNALS

70% of respondent are willing to use micromobility for their daily commute, most of the prefer ownership, follow by leasing or subscription model. Being

Sharing the last preferred model

79% of city inhabitants have **less than 3 micromobility apps installed** in their smartphones (FROM 2021)

pony moovit

Pony (micro) and Moovit (MaaS) integration

TIER FREENOW

Tier (micro) and Free Now (sharing) integration

TIER amag

Tier and AMAG Innovation Venture Lab

pickebike Google Maps

Pick ebike is now integrated with Google Maps

HELBIZ WHEELS

Helbiz acquire Wheels

TIER Google Maps

Tier and Google maps partnerships continues

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SIGNALS

BIRD

Electric scooter and micromobility giant Bird **lays off 23% of employees** in extreme cost cutting

voi.

Just a year after its $91.3 million fundraise, the Swedish e-scooter and micromobility outfit Voi is **cutting 13% of its workforce.**

HELBIZ

Helbiz partnership with hailing

Helbiz pulls back from ‘non-profitable markets’

SPIN

Tier-owned Spin exits 10 US markets amid low demand, unfavorable city regulations.

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NEW REVENUE STREAMS: VEHICLE FUNCTIONALITY SUBSCRIPTIONS

DESCRIPTION

Saying that our world is a software driving worl is not something new. And this sentence is also true for automakers. They automakers are planning to charge for advanced driving features on a subscription basis. Tesla is already doing it, and Volkswagen has announced that it will soon follow suit... This is the kind of idea that looks fabulous on paper (or should we say, in Excel): money, and bags of it. But it carries an enormous risk. Loyal brand consumers could feel betrayed if they perceive that they are being sold unfinished products. We only need to look at the world of gaming to see how EA (Electronic Arts) has become a hated brand for selling very expensive games (known as AAAs) which then have expensive and plentiful downloadable content for purchase separately. A new technological feature lies behind this new business model and acts as an enabler, namely, OTA (Over The Air) software updates.

Tesla's AV package is charged separately from the car purchase. Volkswagen is looking to sell AV capabilities by the hour (and they are not cheap, at around €8.5/h). **BMW is selling heated seats** [🔗] in some countries for $18 a month. Last year, General Motors said it earned over $2 billion in in-car subscription service revenue, a number the company expects to grow to $25 billion by the end of the decade. And Stellantins expects to earn **$22.5 billion from in-car software purchases by 2030**. [🔗] These figures would essentially put GM and Stellantins in the same league as Netflix, Spotify, and Peloton.

RELATED MACRO TRENDS

- DATA & CONNECTIVITY
- NEW BUSINESS MODELS

YEARS TRACKED

2

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SIGNALS

Whilst discussing this topic, it is well worth mentioning the case of the Audi owner who found their **basic HVAC functionality blocked** [🔗] by a paywall. That certainly wasn't planned. It was a mistake. But it clearly shows that everything can be done nowadays and, naturally, mistakes can be made, including dangerous ones.

Now, of course, consumers are not willing to pay for things that they consider basic. And with this in mind, **Cox Automotive** [🔗] conducted a study to see what buyers thought of all these add-ons. Consumers made it clear that safety and comfort features should be part of the purchase price. Specifically, 92% of respondents said that heated and cooled seats should be part of the purchase price; 89% said that remote start should be included too. Both of these features have been discussed by automakers for inclusion within subscription features. In terms of security features, the response was almost as overwhelming; 89% of respondents said lane-keep assist should be included in the list price; and 87% said automatic emergency braking should be a basic feature too. Having said that,consumers do seem to be willing to pay for other features. The key here is not to tighten the rope too much and cause a rebound effect. Brand loyalty is on the decline and brands should be wary of pushing their luck with customers.

- Audi owner finds basic HVAC function paywalled
- Augustin Friedel BMW from heat seating charge
- Mercedes acceleration paywall
- Features removed by Tesla
- OTA in all Volvo models
- Stellantis CEO Carlos Tavares anticipates that the company will rake in $22.5 billion in software sales alone by 2030

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ARE OEMs BECOMING SOFTWARE COMPANIES? AND AT WHAT COST?

DESCRIPTION

OEMs are competing with each other to hire as many software developers as they can. At least that is what it looks like from the outside, with automakers announcing massive product development initiatives and hiring experts across different fields (including software development, VC, M&A, etc). This is creating an interesting internal challenge as all these structural changes take a while to start working properly and without friction. It is also generating resistance externally as specialist software companies fight hard to operate in the automotive revenue mix.

Let us consider the example of Ford, which wants to create a 100% software structure that can be continuously updated (i.e: AI systems, autonomous driving, etc). **To achieve this aim, the firm is currently looking to recruit people to fill 261 ¨software engineer¨ roles on Linkedin.** [🔗] This is especially striking given that the company is simultaneously axing many of its traditional positions (e.g., it recently announced it was cutting 8,000 workers from its gas-powered business departments to make way for software driven positions).

Another good example is VW, which despite its relentless efforts is still restructuring Cariad, its digital services division. Indeed it can't afford not to, given that earnings projections in the automotive world increasingly place more weight on revenues generated by the software layer than from the core business itself.

RELATED MACRO TRENDS

- WEB3
- TRANSPARENCY & SECURITY
- DATA & CONNECTIVITY
- NEW BUSINESS MODELS

YEARS TRACKED

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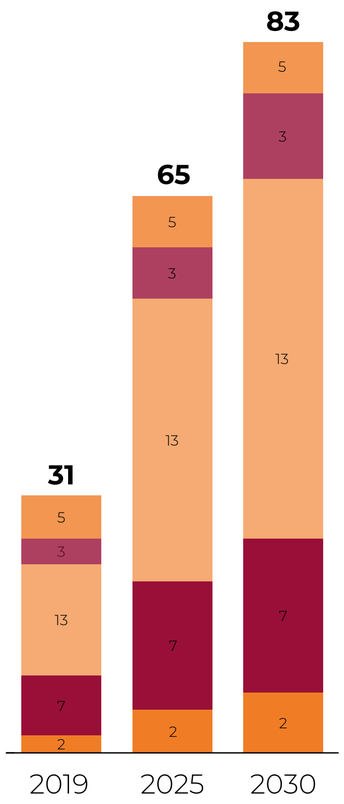
SIGNALS

The **automotive software market is projected to more than double in size** from $31 billion in 2019 to roughly $80 billion in 2030—a CAGR of more than 9 %

Total automotive software market, $ billions



	CAGR 2019-2030, %
Total	+9.4
Powertrain and chassis	+1.1
Body and energy	+9.8
ADAS and HAD	+11.3
Infotainment, connectivity, security, connected and services	+9.1
Operating system and middleware	+11.6

Hiring activity related to cloud increased by 18% in the auto industry in Q3 2022

Volkswagen is implementing a **program to form software engeenerers** through its in-house AutoUni and the Group Academy. It is called Faculty 73, and people that graduates have automatically a full time job in the automaker

GM Adds **3,000 New Tech Jobs** to Boost Virtual Testing and Software Expertise

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VERTICAL INTEGRATION

DESCRIPTION

In light of the complex geopolitical backdrop in recent years many automobile companies have decided to “tie up” their value chain. Their aim is to take back control and reduce their exposure to risks beyond their realm.

On the ground, this involves the construction of new plants in territories close to, or controlled by, its most important markets, as well as investment, acquisitions and joint ventures with key companies along their respective value chains. Whatever it takes for them to continue with business as usual.

This trend is encompassed within an even greater process of “deglobalization”. Which means a process to relocate production to take it closer to strategic controlled regions, to ensure that the key pieces in the pack of dominoes are controlled and will thus cause fewer problems.

The cost of having a factory shut down is immense. But even more immense is the real cost for a brand of not being able to supply its consumers. **Loyalty to automotive brands is in decline** [🔗] and the rebound effect (let me see what other brands can offer me) is increasing as the supply limitations continue.

RELATED MACRO TRENDS

- **REDEFINING GLOBALIZATION**

YEARS TRACKED

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SIGNALS

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Cost of having a manufacture plant closed:

$22,000 per minute

€2 billion per week,
according to Herbet Diess (ex VW CEO)

Own factories of critical components

- Volkswagen Is Looking at Making Its Own Batteries in North America
- Ford breaks ground on $5.6B EV 'mega campus'
- Cruise is making its own chips
- Tesla evaluating to build lithium refinery plant.

M&A

- Bosch buy Motech
- Stellantins invest in Vulcan Energy Resources
- Nio invest in lithium mining company
- General Motors agreed to pre-pay Livent, a lithium mining group, $200mn to secure supplies
- Ford said it would stump up financing for Liontown Resources to develop a lithium mine.

E-CARGO BIKES ON THE RISE

DESCRIPTION

Part of the future of urban delivery is undoubtedly e-cargo bikes. With the growth of e-commerce and the increase in traffic and space usage problems on our curbs and sidewalks, e-cargo bikes offer an efficient, green and hassle-free last mile solution. They are also a lot cheaper than traditional delivery vans and other alternatives. The TCO (Total Cost of Ownership) of an e-cargo bike and a van is incomparable (a van proves a lot more expensive). Also, e-cargo bikes are more efficient in terms of delivery times with several studies showing that e-cargo bikes deliver goods more quickly than their 4-wheeled rivals.

For instance, in November 2022, Amazon expanded its e-cargo bike delivery service to the UK, specifically, to London and Manchester. This launch forms part of Amazon's aim to increase its e-cargo deliveries in the UK to 2 million customers a year. For this, Amazon is planning to invest $300 million GBP in the electrification and decarbonization of its transportation fleet to reduce congestion levels and in turn cut pollution too.

Also in this space, several startups are currently developing e-cargo bikes that look amazing. Keep an eye out for: EAV, Ono Motion and Fulpra.

RELATED MACRO TRENDS

- **URBANIZATION**
- **DECARBONIZATION**

YEARS TRACKED

2

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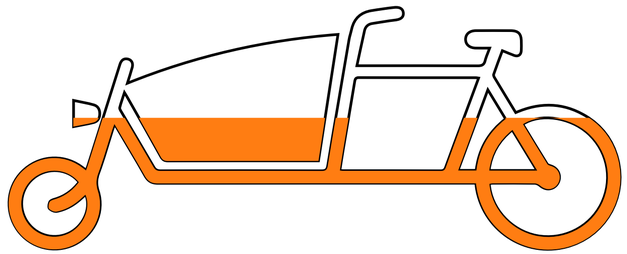
SIGNALS

On average, the bikes were **1.61 times faster** as they benefit from being able to take shortcuts through streets blocked to motor traffic and can quickly park up close to their destinations to drop off package

Ecargo bikes deliver about **60% faster than vans** in city centers. (FROM 2021 BUT SEEMS RELEVANT)

The **global ecargo bikes market**, reached a value of about USD 49.7 billion in 2022. The market is further expected to grow at a CAGR of 10.2% in the forecast period of 2022-2027 to reach a value of approximately USD 80.6 billion by 2027.of 10.2% in the forecast period of 2022-2027 to reach a value of approximately USD 80.6 billion by 2027



10,2%
2022-2027

Cargoroo

Amsterdam's **'Uber' of electric cargo bikes**
Cargoroo pedals €10M funding

amazon

Amazon expands **electric cargo bike deliveries** in Manchester and London

amazon DHL IKEA

These **retail giants** (Amazon, DHL, Ikea) are starting to make deliveries with electric cargo bikes

IKEA

Ikea is using **solar powered** ecargo bikes

RENAULT

Renault Trucks enter **ecargo bike market**

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ELECTRIC VERTICAL TAKE-OFF AND LANDING (EVTOL) TAKE OFF

DESCRIPTION

The power of eVTOL technology to unlock mobility and alleviate the land transport bottleneck is mindblowing. eVTOL vehicles have evolved rapidly over the last 3 years. The first prototypes were launched just 5 years ago and now, serious flight trials are being conducted all over the world.

Major cities are conducting pilots, and several major airlines are investing in the startups that are developing these aerial assets. The next 3-5 years are going to be key to increasing the value chain in this market.

Meanwhile, companies like UAP, backed by Supernal, a division of Hyundai, are announcing plans to create 200 Vertiports (infrastructures designed for this vehicles that works exactly as an airport for planes), a much needed part of the eVTOL infrastructure.

Furthermore, when we consider eVTOLs, it is interesting to note that the capability of these aircrafts is not limited to civilian transportation activities. A nice example of an alternative use is the American company Elroy Air that has developed a logistics based eVTOL called the ¨Chaparral¨ for defense, commercial and humanitarian use. The company has already secured commitments for 500 aircrafts (equivalent to a total contract size of $1 billion) The US Army is also testing and financing an eVTOL aircraft for military missions, giving further support to the statement that eVTOLs are really taking off!

RELATED MACRO TRENDS

- URBANIZATION
- NEW BUSINESS MODELS
- DECARBONIZATION

YEARS TRACKED

2

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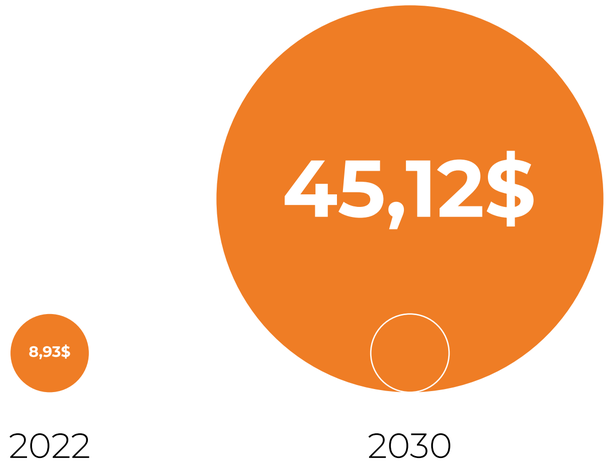
SIGNALS

The global advanced aerial mobility market size

was estimated at USD 8.93 billion in 2022 and is expected to hit around USD 45.12 billion by 2030 and is poised to grow at a compound annual growth rate (CAGR) of 22.45% during the forecast period 2022 to 2030



More than 4,600 eVTOL **orders secured** as industry strengthens in 2022

wisk AVOLON AirAsia luxaviation

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SIGNALS

Jeep, Dodge, Ram, Chrysler Automaker to Build **Air Taxis**

American Airlines and FlyingGroup confirm orders for **fifty aircraft** from Vertical Aerospace

Lilium Closes **$119 Million** Capital Raise

Saudi Arabian airlines **orders aircraft** from Lilium

Joby Applies for **Certification of its eVTOL** in Japan

Elroy Air Secures **More Than $2B** in Total Aircraft Demand

Elroy Air Unveils Its Chaparral, a First-of-its-kind, **Autonomous, Hybrid-electric VTOL Cargo Aircraft**

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SIGNALS

Volocopter Collaborates with Microsoft on **VoloIQ Aerospace Cloud Project**

VOLOCOPTER

Volocopter, Skyports Inaugurate **New Vertiport** for UAM Testing In Paris

Stellantis **raises eVTOL deal** with Archer to the next level

STELLANTIS ARCHER

Archer Receives **$10M Pre-Delivery Payment** from United Airlines for 100 eVTOLs, Shares Q2 Financial Results

Electra Announces **Sale of 1,000th** eSTOL Aircraft

ELECTRA.AERO

HYUNDAI

Hyundai Says Flying-Taxi Efforts Likely **Won't Need External Funding**

VPorts inks agreement to create world's **1st advanced air mobility integrator center** in Dubai

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THE RISE OF THE MOBILITY SUPER APPS

DESCRIPTION

We expect to see companies continue to build up aggregated offers (MaaS - Mobility As A Service) both those firms created specifically to be mobility providers as well as technological players seeking out opportunities as the experts in integrating services.

Most recently, this super integration has led to the creation of several Super Apps - single platforms that offer all kinds of services - from mobility to health services. The phenomenon originated in Asia and is now spreading around the Planet.

There is one type of integration integration approach worth mentioning, known as Walled Gardens, which are broad offers made by a single supplier. The best examples are Apple and Google. These companies offer multiple services and products in such a way that the user ends up in a kind of relationship with them. This kind of relationship is one which is very difficult to exit, hence the name. The convenience such suppliers offer means we forgive their failures, since leaving their ecosystems is more complex than turning a blind eye to their problems and inefficiencies. This approach is the one followed by most of the big startups that were created as hailing services and that are now adding multiple mobility services as fast as they can (e.g. Gojek, Uber, Cabify...).

RELATED MACRO TRENDS

- **URBANIZATION**
- **NEW BUSINESS MODELS**
- **DECARBONIZATION**

YEARS TRACKED

2

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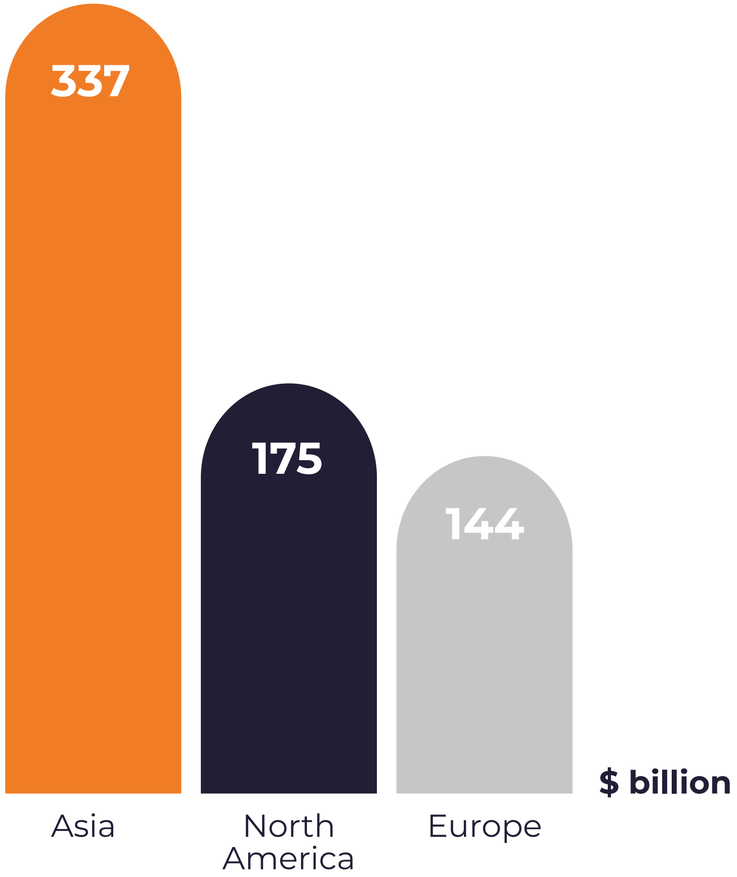
SIGNALS

Asia's mobility service market is expected to climb to $337 billion by 2030

higher than that of North America ($175 billion) and Europe's ($144 billion), according to research by the Oliver Wyman Forum. And this market is drived by Super Apps



Mobility Service Market

Super Apps

Grab
gojek

Walled Garden

Uber
cabify

Decentraliced Ecosystems

iomob
bloX.move

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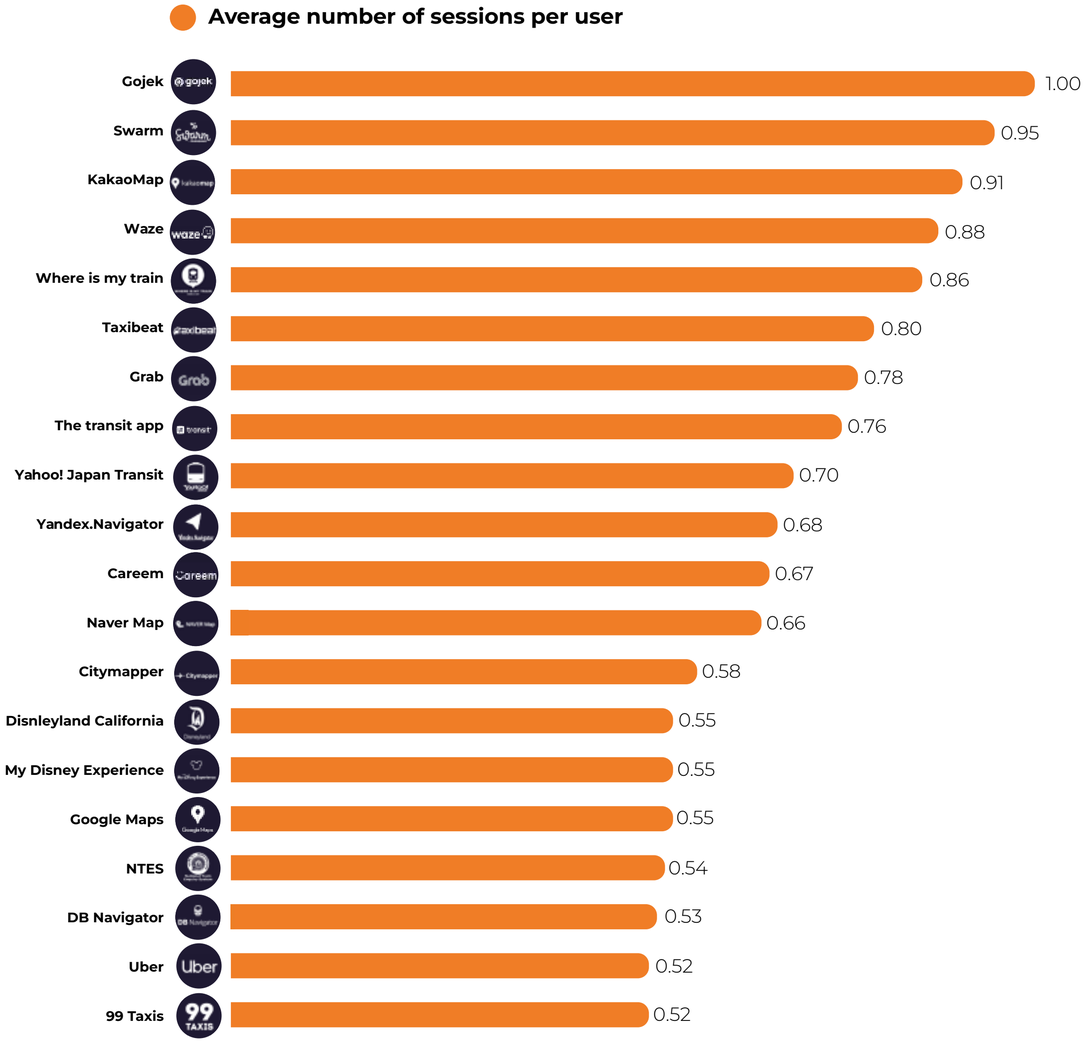
SIGNALS

A supper mobility app generates more engagement that other types of mobility apps

Apps with the highest engagement in travel & mobility tech



Companies that are launching super apps

Uber

FREENOW

TMC

Transport super-apps will be
all encompassing in 2030

Barriers to a
Europe-wide mobility Super App

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CO-OWNERSHIP OF VEHICLES AS A NICHE BUSINESS OPPORTUNITY

DESCRIPTION

Co-owning a vehicle involves owning and sharing the use of a vehicle with another individual referred to as a co-owner who splits the costs of the vehicle with you. While this concept is not new and is favoured by many friends and family members, companies are now redefining co-ownership to turn it into something very trendy.

In India, a new start-up named Prorata has developed a concept to work with residential societies to bring together a group of 4-12 people to co-own vehicles for certain periods of time during a year. So, depending on how much an individual wants to use a vehicle per year, they can buy 1 to 12 tickets and according to the website, ¨1 ticket = 8.33 % ownership of the car = 30 days usage per year for 5 years¨.

In addition to Prorata, another company based in Switzerland called Supercar Sharing AG is also operating in the vehicle co-ownership space. It has a very similar business model to Prorata but is more niche in the sense that it works only with high-end vehicles. The creation of this start-up was inspired by various studies that showed that high-end car owners do not use their vehicles 80-90% of the time, with the result that vehicles are under-utilized and depreciating at the same time.

RELATED MACRO TRENDS

- NEW BUSINESS MODELS

YEARS TRACKED

1

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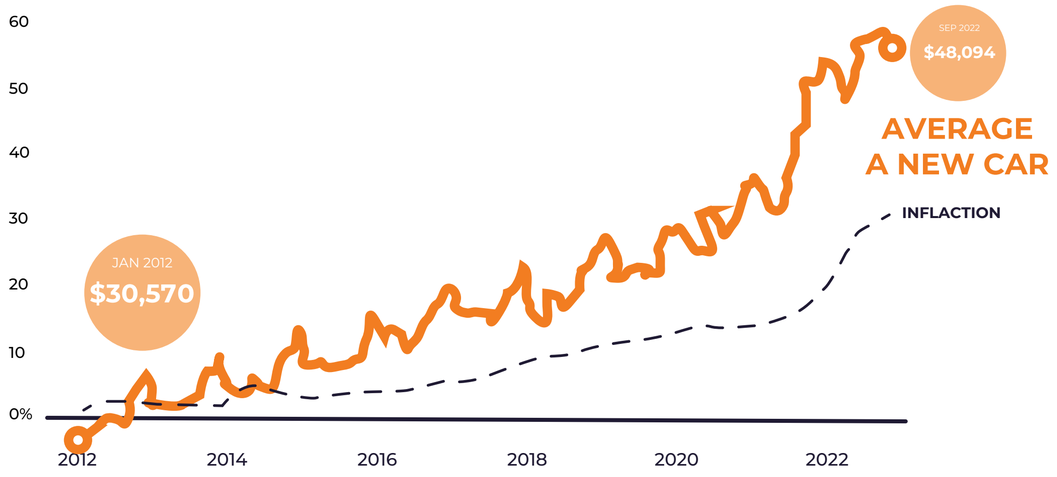
SIGNALS

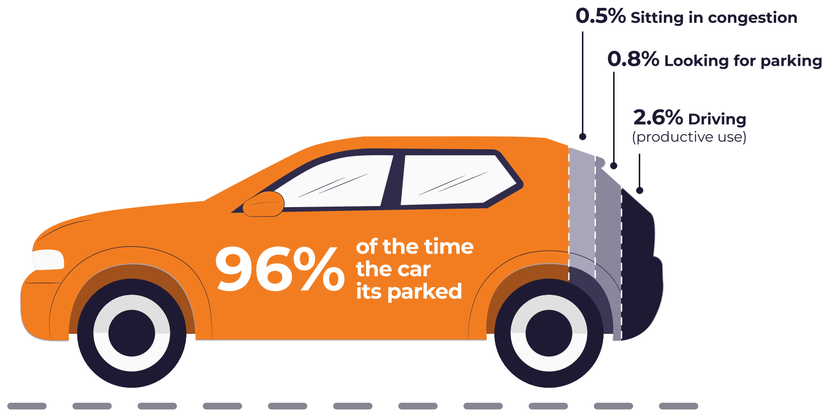
PRORATA

Vehicle co-ownership platform

The Era of Supercar Co-Ownership



Most of the passenger vehicles are parked 96% of the time



An American road reaches peak throughput only 5% of the time even then, it is only 10% covered with cars

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