MOBILITY OF THE FUTURE

LUMINA

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Imagine a world where mobility isn't just about moving people and goods from one place to another—it's about reimagining how cities function and thrive. The Ministry of Mobility finds itself at a remarkable crossroads, with an opportunity to not just build a transportation system but to rewrite the very rules of movement. This is a moment to lean into innovation, embrace sustainable practices, and deploy transformative technologies that don't just keep up with global trends but set them.

DECARBONISATION, DIGITALISATION, and **DECENTRALISATION** aren't just buzzwords; they're the guiding principles for creating a transportation ecosystem that's smarter, faster, and greener. The goal? A shared, sustainable, and autonomous system tailored to the unique needs of its users—a blueprint for a smart city equipped with the most advanced, adaptable systems ever imagined.

But let's be clear: the movement of goods and people cannot be hindered by crumbling infrastructure, outdated systems, or yesterday's technology. Cities in Africa, especially those designed as special economic zones, demand mobility solutions that are faster, cheaper, and more intelligent than anything that came before. These aren't just aspirations; they're non-negotiable.

And yet, understanding what's possible starts with understanding where we are. Context matters. It's not enough to glance at the continent's challenges and call it a day. Africa's story is too nuanced for broad strokes—it must be broken down, step by step: continent to country, country to city, city to community. Only by viewing our mobility challenges through these specific lenses can we design solutions that resonate with the realities on the ground.

It's not just about solving today's problems but doing so in a way that prepares us for tomorrow. By working across three horizons, we can address immediate needs, allocate resources effectively, and build the regulatory and policy frameworks to support long-term transformation. This isn't a sprint; it's a marathon. The question isn't whether we can do it—the question is, will we seize the opportunity before us to build something truly extraordinary?

TYRONE MAGWAGWA
Chief Innovation Officer
Lumina Africa

MOBILITY ECOSYSTEM OF THE FUTURE

THE MOBILITY ECOSYSTEM OF THE FUTURE

What if every car, every bike, every bus wasn't just a tool, but part of an interconnected network that anticipates your needs? A world where:

- **Safety** isn't an afterthought but a foundation, bolstered by self-driving technologies and systems that "talk" to each other to prevent accidents.
- **Efficiency** rules, with congestion and pollution relegated to the ast through shared and smart solutions
- **Sustainability** is non-negotiable, where decarbonisation isn't just a goal but a way of life.
- And **innovation** doesn't just refine how we move—it redefines what it means to move.

But for this vision to materialise, we must first confront the challenges of the present.

URBANISATION AND CONGESTION

African Cities are experiencing significant challenges because their **Cities weren't designed to accommodate majority.** The pre-colonial structures were designed to cater for the minority. The crumbling infrastructure can't sustain over 1**5% annual urbanisation,** and in some cases the people creating informal structures.

With cities bursting at the seams, the daily grind is now gridlock. The challenge isn't just about building more roads; it's about imagining a system where fewer cars mean faster, more efficient movement. We have to employ Zero based and First Principles thinking to solve these challenges.

EXPENSIVE OWNERSHIP

For millions, the car has become a financial albatross. **Ownership is exclusive, expensive, and inefficient.** The real innovation isn't in selling more cars—it's in needing fewer. **Why own a liability you only use on average 4% of the time but still pay insurance, maintenance fees and fuel? 96% of the time it's parked, and depreciate in value.** Yes, it's convenient to have a car you use at any time to go anywhere and still pay less than an Uber. However, we can design cities where it's cheaper and convenient to use shared fleet mobility than to own a liability.

HIGH ACCIDENT RATES

In Africa, approximately **250,000 road traffic fatalities occur annually, accounting for about 20% of global road deaths** despite the continent having only **15% of the world's population and 3% of its vehicles.** In comparison, China (which has similar population) reports around 58,000 road traffic fatalities annually, according to government statistics. India also sits high at about 150 000 accidents annually.

Consider this—while technology has advanced, t**he human cost of poor road safety remains staggering**. This isn't just a failure of systems; it's a failure of imagination.

CARBON EMISSIONS

The modern car—a symbol of freedom for some—is also a harbinger of environmental degradation. Fossil-fuelled transportation accounts for nearly **a quarter of global CO2 emissions.**
The question isn't just how we reduce this—it's how we erase it. Much has been done to reduce carbon footprint, however, **global carbon emissions have gotten worse by 50% from a period of 2000 to 2023.**

REFRAMING THE CHALLENGES

SOCIAL

- **Inequality in Access**: Urban-rural disparities limit access to efficient transport, disproportionately affecting low-income populations.
- **Safety Issues**: High rates of accidents due to poorly maintained roads, overloading, and disregard for traffic rules.
- **Cultural Barriers**: Resistance to shared mobility models or adoption of newer systems due to cultural norms.
- **Urbanisation Strain**: Rapid urban growth creates congestion and insufficient public transport options in cities.
- **Health Impacts**: Exposure to air pollution from poorly maintained vehicles negatively impacts public health.

TECHNOLOGICAL

- **Limited Infrastructure**: Weak ICT and transport infrastructure restrict the adoption of smart mobility solutions.
- **Data Gaps**: Lack of reliable transportation data hinders planning and system optimisation.
- **Slow Adoption of Innovation**:inability to integrate emerging technologies like EVs, autonomous vehicles, or smart traffic management systems.
- **Maintenance Issues**: Shortage of skilled personnel and facilities for maintaining advanced vehicles and technologies.
- **Connectivity**: Low penetration of digital payment systems and connectivity in remote areas restricts adoption of modern mobility services.

ENVIRONMENTAL

- **High Carbon Emissions**: Over-reliance on old, fuel-inefficient vehicles leads to excessive greenhouse gas emissions.
- **Resource Depletion**: Unsustainable extraction of resources for vehicle production and energy needs.
- **Waste Management**: Limited capacity to handle automotive and e-waste, including old batteries and tires.
- **Biodiversity Impact**: Road construction and expansion often encroach on ecologically sensitive areas.
- **Climate Change Vulnerabilities**: Extreme weather events (e.g., floods) frequently damage roads and disrupt transportation networks.

ECONOMIC

- **Expensive Ownership**: Low purchasing power and high import taxes make vehicle ownership unaffordable for many.
- **Underinvestment**: Insufficient public and private investment in transportation infrastructure and innovation.
- **Informal Sector Dominance**: The reliance on informal operators, like minibus taxis, leads to inefficiencies and limited regulation.
- **Fuel Dependency**: Heavy reliance on expensive, imported fossil fuels makes transport systems vulnerable to global price fluctuations.

POLITICAL

- **Taxi Associations**
- **Policy Gaps**: Lack of comprehensive mobility policies that integrate sustainability, safety, and inclusivity.
- **Regulatory Inefficiencies**: Poor enforcement of traffic laws, safety standards, and emissions regulations.
- **Corruption**: Mismanagement of funds allocated for transport infrastructure or development projects.
- **Geopolitical Instability**: Conflict and instability in certain regions disrupt transport networks and investment in infrastructure.

TRAFFIC CONGESTION

4%

96 % of the time parked

13k

People die from accidents

2 Hours

Spent in Traffic on average daily

URBANISATION

70%

Of the population living in URBAN CITIES

15%

Urbanisation rate.12 million People will move to urban Cities by 2050

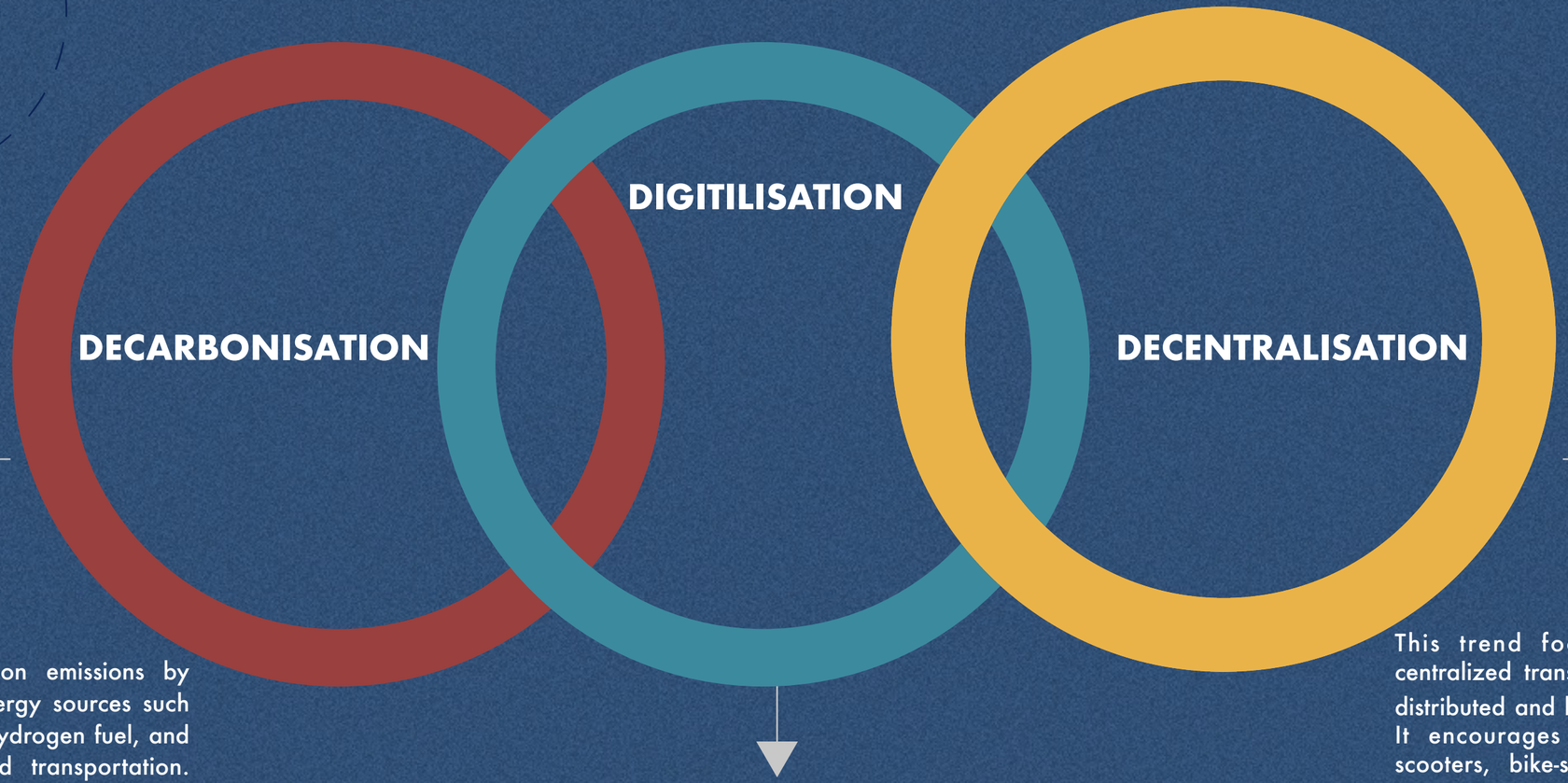
2.5 Billion

Projected Population growth

EXPENSIVE OWNERSHIP

- 70% of car owner can't afford insurance
- Petrol prices have surged by more than 47% since February 2021

MEGA SHIFTS



The goal is reduce carbon emissions by transitioning to cleaner energy sources such as electric vehicles (EVs), hydrogen fuel, and renewable energy-powered transportation.

Impact: It drives the shift from fossil fuels to sustainable mobility solutions, leading to cleaner cities, stricter emissions regulations, and innovations in battery technology and alternative fuels.

We're shifting towards a smarter and more connected mobility ecosystem. This involves integrating digital technologies like AI, IoT, and big data into mobility systems. **Impact:** It enables smart traffic management, autonomous vehicles, connected infrastructure, and ride-sharing platforms, making transportation more efficient, safer, and user-friendly.

This trend focuses on shifting from centralized transportation models to more distributed and localized systems. **Impact:** It encourages micro-mobility (e.g., e-scooters, bike-sharing), community-based transport networks, and decentralized energy grids for EV charging, promoting accessibility, resilience, and reduced congestion in urban areas.

PATTERNS OF CHANGE

Technology adoption in mobility follows a cyclical yet progressive pattern. While innovation pushes industries forward, history often finds its way back into modern solutions. The transformation of transportation –from horse-drawn carriages to electric vehicles–illustrates how mobility technologies evolve, shift in purpose, and sometimes re-emerge in new, hybrid forms.

To understand this trajectory, we outline a **four-phase model of technological evolution**, applicable to the future of mobility and beyond. These phases–**Functional Adoption, Recreational Repurposing, Cyclical Necessity, and Hybrid Integration**–reveal how transport technologies transform in response to efficiency, cultural shifts, and sustainability demands.

PHASE 2 FUNCTIONAL ADOPTION

This early adoption is driven by utility, efficiency, or necessity. The first phase of technological evolution begins with necessity. A new technology emerges as a direct response to an inefficiency, offering improved functionality and adoption at scale. In mobility, this has historically included breakthroughs such as the steam engine, combustion engine, and more recently, electric propulsion systems.

Characteristics: Problem-solving, efficiency-driven, early mass adoption.

Examples:

- **Automobiles replacing horse-drawn carriages** – The shift from animal-powered transport to combustion engines enabled greater speed, convenience, and long-distance travel.
- **Electric Vehicles (EVs) replacing internal combustion engines** – As concerns over emissions grew, EVs emerged as a cleaner alternative.
- **Railways and High-Speed Trains** – Revolutionising trade, logistics, and passenger travel by overcoming geographical constraints.
- **Ride-Sharing Platforms** – Solving inefficiencies in urban transport by optimising vehicle occupancy and reducing congestion.
- **Fire** – Used for warmth, protection, and cooking.
- **Mobile Phones** – Developed primarily for voice communication, replacing landlines.

While these innovations solve immediate challenges, they are not immune to evolution or obsolescence. Over time, technology moves beyond its original function.

PHASE 2 RECREATIONAL REPURPOSING

Over time, as newer technologies emerge, the original technology loses its primary function and shifts toward leisure, sport, or hobbyist use. This happens when advancements make the original use obsolete or less critical. As new mobility technologies replace older ones, some legacy systems transition into recreational use. In this phase, technologies no longer serve as the dominant transport method but remain relevant for leisure, sports, or cultural significance.

Characteristics: Hobbyist adoption, status symbol, cultural or aesthetic appreciation.

Examples:

- **Horses shifting from transportation to equestrian sports and tourism** – Once the backbone of personal mobility, horses are now used in racing, polo, and leisure riding.
- **Classic Cars & Vintage Motorcycles** – Once practical vehicles, now prized collectibles or used for weekend drives and exhibitions.
- **Sailing & Rowing** – With motorised boats dominating commercial and transport applications, sailing and rowing persist as competitive and recreational sports.
- **Steam Locomotives & Heritage Railways** – While electric and high-speed trains dominate modern rail systems, vintage steam trains are maintained for tourism and historical experiences.

This shift is natural as new technologies emerge, but sometimes, external pressures force old technologies back into functional necessity.

PATTERNS OF CHANGE

PHASE 3 CYCLICAL NECESSITY

Due to certain circumstances—such as technological failures, economic shifts, or sustainability concerns—people revert to using the original technology as a necessity rather than just recreation. This stage often arises when modern solutions prove unreliable, unsustainable, or too costly.

In certain scenarios, reliance on older technologies resurfaces—not as a nostalgic choice but as a practical or economic necessity. This phase is often triggered by failures in modern infrastructure, cost limitations, or environmental considerations.

Characteristics: Resource-driven, economic necessity, resilience-focused.

Examples:

- **Bicycles returning as primary transport due to rising fuel costs** – In cities facing fuel shortages or economic downturns, bicycles regain importance as an accessible and cost-effective alternative.
- **Rail freight resurgence amid supply chain disruptions** – With increased pressure on road logistics and sustainability concerns, rail freight is being revived for cargo transport.
- **Walking and non-motorised transport in urban settings** – As urban congestion rises and cities prioritise pedestrian-friendly spaces, walking and cycling lanes are reintroduced.
- **Sail-Powered Shipping** – With increasing fuel costs and emissions regulations, some logistics companies are reconsidering wind-assisted shipping methods.

This phase highlights the resilience of older mobility solutions. However, rather than simply reverting to outdated methods, the most forward-thinking industries seek to merge the old with the new—leading to the next phase.

PHASE 4 HYBRID INTEGRATION

Instead of allowing old technologies to fade away, the most impactful innovations combine traditional mobility solutions with modern advancements. This phase represents the optimal balance between historical reliability and cutting-edge efficiency. Hybrid integration is particularly crucial in the transition toward sustainable mobility, where lessons from the past inform the technologies of the future.

Characteristics: Technology fusion, enhanced efficiency, sustainable reinvention.

Examples:

- **Electric Bicycles (E-Bikes) & Pedal-Assist Vehicles** – Traditional cycling is enhanced with battery-powered assistance, making it a viable alternative to cars in urban areas.
- **Autonomous, Solar-Powered Boats** – Maritime industries are integrating AI navigation with solar propulsion to improve efficiency and sustainability.
- **Hydrogen-Powered Trains** – Classic rail infrastructure is being modernised with zero-emission hydrogen fuel cell technology.
- **Airships & Dirigibles Reinvented for Green Cargo Transport** – Once obsolete, airships are re-emerging as a low-carbon alternative for transporting goods.
- **Smart Road Infrastructure Integrated with EV Charging Lanes** – The future of highways includes wireless charging roads, blending old transport networks with new energy solutions.

Hybrid integration is the future of mobility—not just revisiting old ideas but reinventing them for a sustainable and connected world.


RIDE OF THE FUTURE WILL BE SHARED

SHARED

From the **TUK-TUKS** of Kenya to the taxis and **MYCITI** buses of South Africa, the idea of personal car ownership is fast becoming obsolete. In its place, a new reality is emerging—one where access trumps ownership, and mobility is a service, not a possession.Fifteen years from now, the urban landscape will be defined by an ecosystem of interconnected transport options—autonomous shuttles, electric ride-pools, micro-mobility hubs, and AI-optimised routes—accessible to all, affordable, and sustainable.

Imagine stepping outside your home and effortlessly summoning an autonomous electric ride to your destination, using a digital wallet to pay for a service that blends ride-sharing, car-pooling, and even bike rentals in one seamless experience. The need for personal car ownership is no longer relevant, as the mobility of the future revolves around flexibility, efficiency, and community.

Privately owned vehicles are parked 95-96% of the time. This underutilisation wastes resources such as parking space, manufacturing materials, and energy. Ownership is expensive, including initial purchase costs, insurance, maintenance, and fuel/charging expenses. Shared mobility models provide a more cost-effective alternative.

RIDE OF THE FUTURE WILL BE SHARED

KEY TRENDS

1. ON DEMAND

Imagine stepping outside your home in 2040. There's no driveway, no garage—because personal car ownership has become as unnecessary as owning a horse in 1920. Instead, you request a ride using **your city's AI-driven transport grid**. Within seconds, an autonomous electric pod arrives, pre-configured to your preferences—seat temperature, ambient lighting, even your favourite playlist.

The vehicle is **not yours, but it feels like it.** It remembers your past rides, your schedule, even your coffee order. It's fully autonomous, weaving effortlessly through streets optimised for self-driving fleets. No traffic lights. No honking. No frustration.

Why? Because by 2040, the inefficiencies of human-driven, individually owned cars have been engineered out of existence.

The result?

- **No more parking lots**—replaced by green spaces and urban farms.
- **No more waiting**—AI anticipates demand, reducing idle time.
- **No more congestion**—with fewer vehicles needed to serve more people.

In the future, mobility isn't about *owning* a car. It's about summoning *exactly* what you need, precisely when you need it.

2. MULTIMODAL

Today, switching from a train to a scooter to a car-share requires multiple apps, payments, and transfers. It's disjointed. Messy. In 2040, that friction is gone.

Mobility is now **orchestrated, not fragmented**. Your journey—whether across town or across the country—is a single, fluid experience. An AI-powered **Mobility-as-a-Service (MaaS) platform** stitches everything together, optimising your route in real time.

Need to get to a meeting? Your personal assistant books a **fully electric autonomous shuttle** to the train station. As you exit, an **e-bike is already waiting** for the final stretch. Your payment? Invisible. Your transfers? Effortless.

The system is designed for **efficiency, not chaos.**

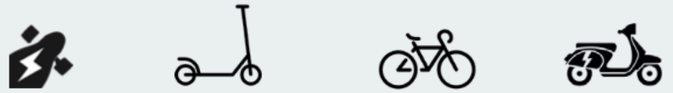
The impact?

- **Less waste**—no single mode dominates; everything is optimized.
- **More freedom**—no need to plan routes; the system does it for you.
- **Better cities**—less congestion, fewer emissions, and smoother commutes.

By 2040, mobility isn't about choosing between cars, buses, or bikes. It's about **flowing through a network** that adapts to your needs in real time.

MULTIMODAL

Micro-Mobility



0–5

60% of trips in the US

Electric bikes, scooters, skateboards

Medium Distance

5–15

25% of trips in the US

Ride-hailing

Long Distance

15+

15% of trips in the US

Car-sharing, public transport, aerial transport

SPIN
/skip/
scoot
BIRD
JUMP
BOOSTED
mobike
hellobike.
motivate
get going
ofo
Lime
NEWHEEL
RIDE
voi.

UBER
Gett
99 TAXIS
OLA
DiDi
via
Grab
lyft
GOJEK
An Ojek For Every Need

MAVEN
CAR SHARING
TURO
hyperloop one
THE BORING COMPANY
SEABUBBLES
UBER Elevate
CAR2GO
Getaround
faradair
boom
LILIUM
HyreCar

RIDE OF THE FUTURE WILL BE SHARED

KEY TRENDS

OWNERSHIP TO RENTERSHIP

In 2024, car ownership is still an aspiration. In 2040, it's an anachronism. **Why own something that sits idle 95% of the time when you can have instant, frictionless access to a fleet of vehicles optimised for every journey?**

Subscription-based mobility dominates. Need a sleek pod for your morning commute? A rugged off-roader for a weekend escape? A luxurious capsule for a night out? **You access, not own.**

The shift is cultural as much as economic. **Young people in 2040 don't dream of owning cars.** They dream of experiences, flexibility, and sustainability. The garage has been repurposed into a home gym, an office, or extra living space.

What happens when ownership disappears?

- **Household costs plummet**—no insurance, no maintenance, no depreciation.
- **Traffic drops dramatically**—because vehicles are no longer personal possessions taking up space.
- **Cities breathe again**—less congestion, more walkable neighbourhoods, and human-centred design.

CONNECTED ECOSYSTEMS

In 2040, mobility is no longer a standalone industry. It's deeply integrated into a larger connected ecosystem—energy, infrastructure, AI, and sustainability working in harmony.

Here's how it works:

- **Autonomous vehicles charge wirelessly while in motion, eliminating range anxiety.**
- **Traffic doesn't exist—because AI synchronises movement, preventing bottlenecks before they happen.**
- **Smart roads repair themselves—using self-healing materials that adapt to climate conditions.**
- **Public transport is predictive—your commute is optimised before you even think about it.**

The mobility network is now a living, breathing system—an intelligent organism that constantly learns, adapts, and improves.

The result?

- **Zero wasted energy—every vehicle, every trip is optimised.**
- **Zero inefficiencies—because humans are no longer the weakest link in transportation.**

RIDE OF THE FUTURE WILL BE SHARED

FOCAL POINT

- **On-Demand Access** – Ride-sharing and micro-mobility services are available at the touch of a button, reducing wait times.
- **Integrated Ecosystem** – A unified platform for everything from ride-pooling to e-scooter rentals, making travel simpler and more connected.
- **Last-Mile Connectivity** – Micro-mobility options like e-bikes and tuk-tuks are perfect for short trips or bridging gaps between public transport modes.
- **Cost-Effective** – Shared rides significantly reduce the cost per journey, especially when compared to owning and maintaining a car.
- **Dynamic Pricing** – The ability to optimise routes and group rides based on demand leads to lower, more flexible pricing models.
- **Pay-Per-Use Model** – Users only pay for what they use, which is particularly advantageous for occasional travellers.
- **Increased Access to Mobility** – Affordable shared transport opens up opportunities for people from all economic backgrounds to access work, education, and healthcare.

KEY PLAYERS

Ride-Sharing Platforms:

Bolt (Estonia/Africa) –Uber (U.S.) Yego Mobility (Rwanda) – SWVL (Egypt) –

EV & Clean Energy Innovators

- **Roam (Kenya)** – Producing electric buses and motorcycles for shared mobility.
- **Kofa (Ghana)** – Developing battery-swapping solutions for electric fleets.
- **Ampersand (Rwanda)** – Leading Africa's transition to electric two-wheelers for ride-hailing.
- **Flutterwave & Paystack (Nigeria)** – Fintech leaders making frictionless, digital mobility payments possible.
- **M-KOPA (Kenya)** – Pioneering pay-as-you-go financing for EVs and mobility access.
- **Starlink (Global/Africa)** – Expanding connectivity for ride optimisation.

Autonomous & AI-Driven Mobility

- **Moove (Nigeria)** – Providing vehicle financing for ride-hailing drivers, potentially shifting to self-driving EV fleets.

KEY CHALLENGES

- **Low Utilisation Rates**: Privately owned vehicles are parked 95-96% of the time. This underutilisation wastes resources such as parking space, manufacturing materials, and energy.
- **Cost Burden**: Ownership is expensive, including initial purchase costs, insurance, maintenance, and fuel/charging expenses. Shared mobility models often provide a more cost-effective alternative.

KEY OPPORTUNITIES

- **Localised EV Manufacturing**
- **Battery Tech** – Opportunities for African startups to build homegrown solutions.
- **AI-Powered Route Optimisation** – Reducing congestion and making shared rides more efficient.
- **Integration with Fintech & Digital ID** – Enabling seamless, cashless, and even credit-based access to mobility.
- **Micro-Mobility Expansion** – Bikes, scooters, and electric tuk-tuks complementing shared rides.
- **Integrated Ecosystem**

RIDE OF THE FUTURE WILL BE SAFE

In the 20th century, driving a car was a rite of passage. You turned sixteen, you passed a test, and suddenly, the road was yours. But by 2040, this will feel as outdated as using a paper map or hailing a cab with your hand.

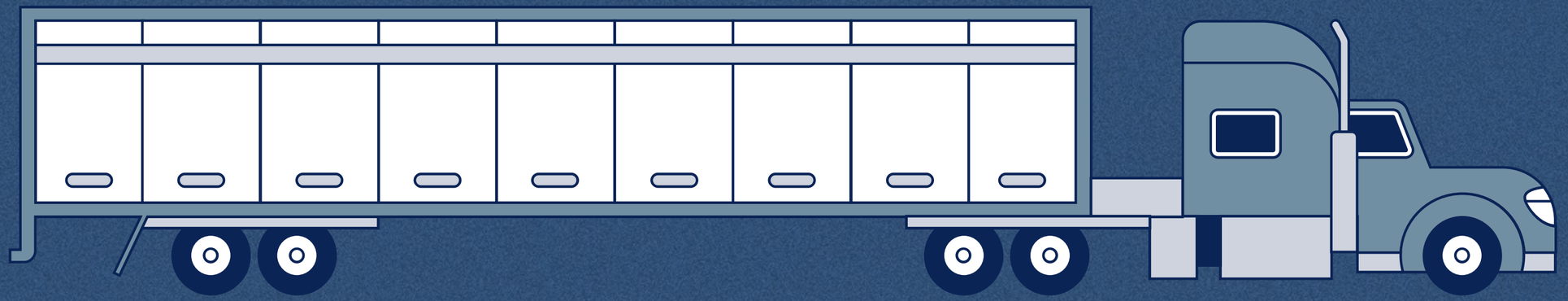
How We'll Take the Keys Away

It won't happen overnight. But slowly, methodically, society will begin to question: *Why do we let humans drive at all?* Accidents—once blamed on bad roads, bad weather, or bad luck—will be traced back to one irrefutable fact: *Humans are the weakest link in transportation safety.*

Governments will introduce tiered restrictions. First, AI copilots will become mandatory. Then, human driving will be limited to certain areas, much like horses were once pushed out of city streets. Insurance costs for human drivers will skyrocket. And then, one by one, the world's leading economies will stop issuing driver's licenses altogether.

Owning a car will become *the* outdated idea. Shared, on-demand fleets—autonomous ride-hailing, subscription-based mobility, and even car-sharing networks powered by blockchain—will dominate. Mobility will be frictionless, personalized, and, most importantly, safe.

By 2040, you won't teach your kids how to drive. You'll teach them how to interact with intelligent machines. And they'll wonder why we ever trusted humans with the wheel in the first place.



RIDE OF THE FUTURE WILL BE SAFE

KEY PLAYERS

Tesla – Pioneering full self-driving (FSD) and neural network-based autonomy,

Mobileye (Intel) – Developing AI-powered vision systems, mapping, and driver-assist technologies used by major automakers.

Nvidia – Building AI supercomputers (like Drive Orin and Pegasus) that power next-gen self-driving systems.

Cruise (GM) – Focused on fully autonomous robo-taxis with redundant safety systems to eliminate human error.

Siemens Mobility – Building AI-driven traffic management systems and connected infrastructure to reduce accidents.

Huawei & Ericsson – Leading 5G-powered vehicle-to-everything (V2X) communications, allowing cars to "talk" to each other and their surroundings.

Cavnue – Developing smart roads that integrate with autonomous vehicles for safer driving.

Volvo – Pioneering accident-prevention systems with AI-based monitoring, speed control, and crash avoidance.

Waymo (Alphabet/Google) – Their self-driving tech is among the most advanced, using LiDAR, radar, and AI to predict and prevent accidents.

KEY PLAYERS

Mercedes-Benz – First to introduce Level 3 self-driving tech with redundant safety systems.

BlackBerry QNX – Providing secure operating systems for autonomous and connected vehicles.

GuardKnox – Specialising in vehicle cybersecurity to prevent hacking of AI-driven systems.

DeepRoute.ai & Pony.ai – Developing robust autonomous algorithms with safety-focused redundancies.

Joby Aviation & Archer Aviation – Developing eVTOL (electric vertical takeoff and landing) aircraft with redundancy in propulsion for safe urban air mobility.

Airbus (CityAirbus) – Pioneering autonomous air taxis with AI-assisted navigation and collision avoidance.

Toyota Research Institute – Investing in Guardian AI, a safety net that steps in only when a driver is at risk.

KEY CHALLENGES

Human Resistance – Some people *like* driving. Some industries *depend* on human drivers. The shift will spark protests, lawsuits, and political battles.

Cybersecurity Threats – When cars are software, hacking becomes the new form of hijacking. Ensuring robust security will be critical.

Infrastructure Overhaul – Not every country will afford smart roads or autonomous networks. A two-tier mobility system could emerge, where some regions move on from human driving while others lag behind.

KEY OPPORTUNITIES

Safety-as-a-Service – AI systems that monitor entire transport ecosystems, preventing accidents before they happen.

Autonomy Integration – Companies that specialise in retrofitting existing vehicles with self-driving capabilities will boom.

Next-Gen Licensing – Instead of a driver's license, people may need "mobility certifications" to operate different automated systems.

SAFE

Predictive AI and Digital Twins

Imagine a world where roads *learn* from every near-miss, and traffic systems *know* where accidents will occur before they do. That's the promise of Predictive AI and Digital Twins.

- **What It Is:** Digital twins are real-time virtual replicas of cities, vehicles, and entire transportation systems, continuously updated with live data. Predictive AI uses this data to anticipate traffic conditions, mechanical failures, and human behaviours before they cause disruptions.
  - **Proactive accident prevention** – AI will detect risky patterns (e.g., a high number of near-misses at an intersection) and suggest fixes before crashes occur.
  - **Dynamic traffic flow management** – Smart signals and adaptive routing will eliminate congestion, reducing travel time and emissions.
  - **Autonomous vehicle self-optimisation** – Cars will use AI to adjust driving behavior in real time based on weather, road conditions, and even passenger stress levels.

Biometric Safety Protocols

Your future car won't just know your favourite playlist—it will know when you're too tired to drive, when you're intoxicated, or even when you're stressed.

What It Is: Biometric sensors embedded in vehicles will monitor heart rate, eye movement, voice patterns, and even brain activity to detect impairment or distress.

- **No more drunk or drowsy driving** – If your vitals indicate impairment, your car won't let you drive—or will switch to full autonomy.
- **Emergency health response** – If a passenger shows signs of a medical emergency (e.g., a heart attack), the vehicle will autonomously reroute to a hospital.
- **Personalised driving experiences** – Stress detected? The car may adjust temperature, lighting, or even engage autopilot to reduce fatigue.

SOCIAL CREDIT SCORE

Social credit scores won't just determine whether you can get a loan—they'll decide *if* and *how* you move. These AI-driven reputation systems will track behaviour, from traffic violations to how responsibly you use shared mobility services.

What It Is: A digital scoring system that evaluates individuals based on their driving habits, adherence to traffic laws, and even social behaviour.

- Risky drivers may face restricted access to autonomous vehicles or higher costs for mobility services.
- A high social mobility score could grant priority access to premium transportation, lower insurance rates, or exclusive ride-sharing tiers.
- Cities may use it to nudge behaviour, rewarding eco-friendly choices like using public transit or shared autonomous fleets.

Autonomous Everything –

Driving will become an archaic skill—like horseback riding or using a rotary phone. In 2040, nearly every vehicle on the road, in the sky, or in the sea will be fully autonomous.

What It Is: AI-powered self-driving technology will not just replace human-driven cars, but extend to buses, delivery trucks, cargo ships, and even flying taxis.

- **Elimination of human error** – 94% of accidents today are caused by human mistakes. Autonomous systems will virtually eliminate fatal crashes.
- **On-demand mobility for all** – Owning a car will be unnecessary. Autonomous fleets will provide seamless, affordable transportation at the push of a button.
- **More efficient cities** – Smart mobility networks will eliminate congestion by optimising routes in real time, making traffic jams a thing of the past.

KEY PLAYERS

- OEM'S (ORIGINAL ENGINE MANUFACTURER)
- COMPONENTS
- SOFTWARE
- EV CHARGING
- BATTERY MANUFACTURER

EV Battery Manufacturing

GLOBAL COMPANIES

CANADIAN COMPANIES ACTIVE GLOBALLY

EV Components

GLOBAL COMPANIES

CANADIAN COMPANIES ACTIVE GLOBALLY

EV Manufacturers

GLOBAL COMPANIES

CANADIAN COMPANIES ACTIVE GLOBALLY

RIDE OF THE FUTURE WILL BE SELF DRIVEN

For most of the 20th century, driving a car was a symbol of freedom. The open road. The rumble of an engine. The thrill of controlling two tons of steel at 70 KM/H. But by 2040, driving will feel as outdated as dialling a rotary phone.

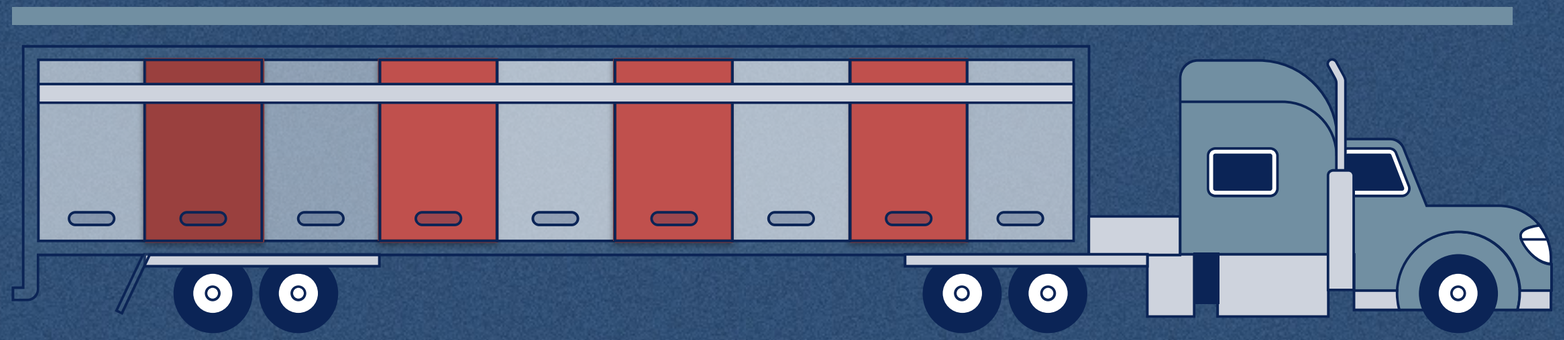
We won't *drive* anymore. We'll be *driven*.

How Mobility Will Be Self-Driven in 2040

Imagine waking up, stepping outside, and finding a sleek, electric pod waiting for you. No driver, no dashboard, no steering wheel –just an AI-powered machine that knows exactly where you need to go.

- Your car will **sync with your schedule** and pick the optimal route before you even leave the house.
- Roads won't be chaotic–vehicles will **communicate with each other**, moving in perfect synchronisation, like a ballet of steel and silicon.
- Speed limits will disappear because accidents will be so rare that safety will no longer be an issue.
- Parking? A relic of the past. Cars won't *stop* anywhere–they'll be in constant circulation, picking up and dropping off passengers like an endless loop of efficiency.

By 2040, the very *idea* of car ownership will seem quaint. You'll summon a vehicle the way you summon an Uber today. But this car won't have a driver–and you won't need to tip.



RIDE OF THE FUTURE WILL BE SELF DRIVEN

KEY TRENDS

1. Level 5 Autonomy Becomes the Standard

- No steering wheel. No pedals. No human intervention. Just pure, AI-driven mobility.
- Autonomous vehicles will handle every road condition—rain, snow, traffic, even unpredictable human pedestrians.

2. Vehicle-to-Everything (V2X) Communication

- Cars will constantly talk to each other, to traffic lights, to smart roads—eliminating congestion and accidents.
- Cities will be redesigned with dynamic lanes that change based on real-time traffic data.

3. AI-Powered Decision Making

- Your car will learn your preferences, mood, and schedule—offering a ride experience tailored just for you.
- It will predict hazards before they happen, slowing down for a potential accident before you even notice the risk.

4. Autonomous Fleets & Shared Mobility

- on-demand self-driving fleets, Cities will prioritize autonomous public transport, reducing the need for individual vehicles altogether.

KEY PLAYERS

Tech Giants & AI Pioneers

- **Waymo (Google)** – The OG of self-driving, with billions of real-world miles logged.
- **Tesla** – Pushing the limits of neural networks for full self-driving.
- **Nvidia** – Building AI supercomputers that run the brains of autonomous vehicles.

Automakers Betting Big on Autonomy

- **Mercedes-Benz** – First to introduce Level 3 self-driving.
- **GM Cruise** – Running full-scale robo-taxi trials in major cities.
- **Toyota Research Institute** – Developing Guardian AI, a backup system that prevents human errors.

Urban & Infrastructure Innovators

- **Cavnue** – Creating smart highways designed for self-driving cars.
- **Huawei & Ericsson** – Leading the charge on 5G-powered V2X communication.

KEY CHALLENGES

Public Trust & Human Resistance

- People don't trust AI yet. Some still think self-driving cars will kill pedestrians or get hacked.
- Governments will need to regulate, but they'll be slow—because bureaucracy and innovation don't mix well.

Cybersecurity & AI Ethics

- Who gets **blamed** when an AI-driven car makes a mistake?
- Hackers will become the new carjackers—except instead of stealing your ride, they might ransom an entire city's fleet.

Infrastructure Upgrades

- Roads, highways, and intersections weren't built for AI. Cities will need to rethink **everything**—and that's expensive.

KEY OPPORTUNITIES

Eliminating Traffic Fatalities – 1.3 million people die in car crashes each year. Autonomous vehicles could reduce that number to near zero.

Making Transportation Universal – The elderly, disabled, and even children will have seamless access to mobility.

Reshaping Urban Spaces – Without parking lots and traffic jams, cities will reclaim space for parks, housing, and businesses.

LEVELS OF AUTOMATION

LEVEL 1: DRIVER ASSISTANCE

Driver Role: Responsible for driving but can rely on specific automated systems for assistance.

Automation Features: Single automated system controls one task at a time, like adaptive cruise control or lane-keeping assistance.

Example: Vehicles with basic ADAS features (e.g., cruise control maintaining a set speed and following distance).

LEVEL 2: PARTIAL AUTOMATION

Driver Role: Responsible for monitoring the driving environment and intervening when needed.

Automation Features: Combines two or more systems, such as adaptive cruise control and lane-centering. However, the driver must remain engaged and ready to take control.

Example: Tesla's Autopilot, General Motors' Super Cruise.

LEVEL 3: CONDITIONAL AUTOMATION

Driver Role: The vehicle handles all aspects of driving under certain conditions, but the driver must be available to intervene when requested.

Automation Features: The vehicle monitors the environment and makes decisions, but in complex scenarios (e.g., severe weather), the driver may need to take over.

Example: Some advanced AV prototypes (e.g., Audi's Traffic Jam Pilot).

LEVEL 4: HIGH AUTOMATION

Driver Role: No intervention required within specific conditions or geofenced areas (e.g., designated city zones or highways).

Automation Features: The vehicle operates entirely autonomously under defined circumstances. Outside these conditions, manual driving may be necessary.

Example: Autonomous shuttles or robotaxis operating in controlled environments.

LEVEL 5: FULL AUTOMATION

Driver Role: None; the vehicle handles all driving tasks under all conditions, with no need for human intervention.

Automation Features: No steering wheel, pedals, or other traditional driver controls. The system is entirely independent.

Example: Fully autonomous, driverless vehicles envisioned for the future (e.g., Waymo's long-term vision).

2040

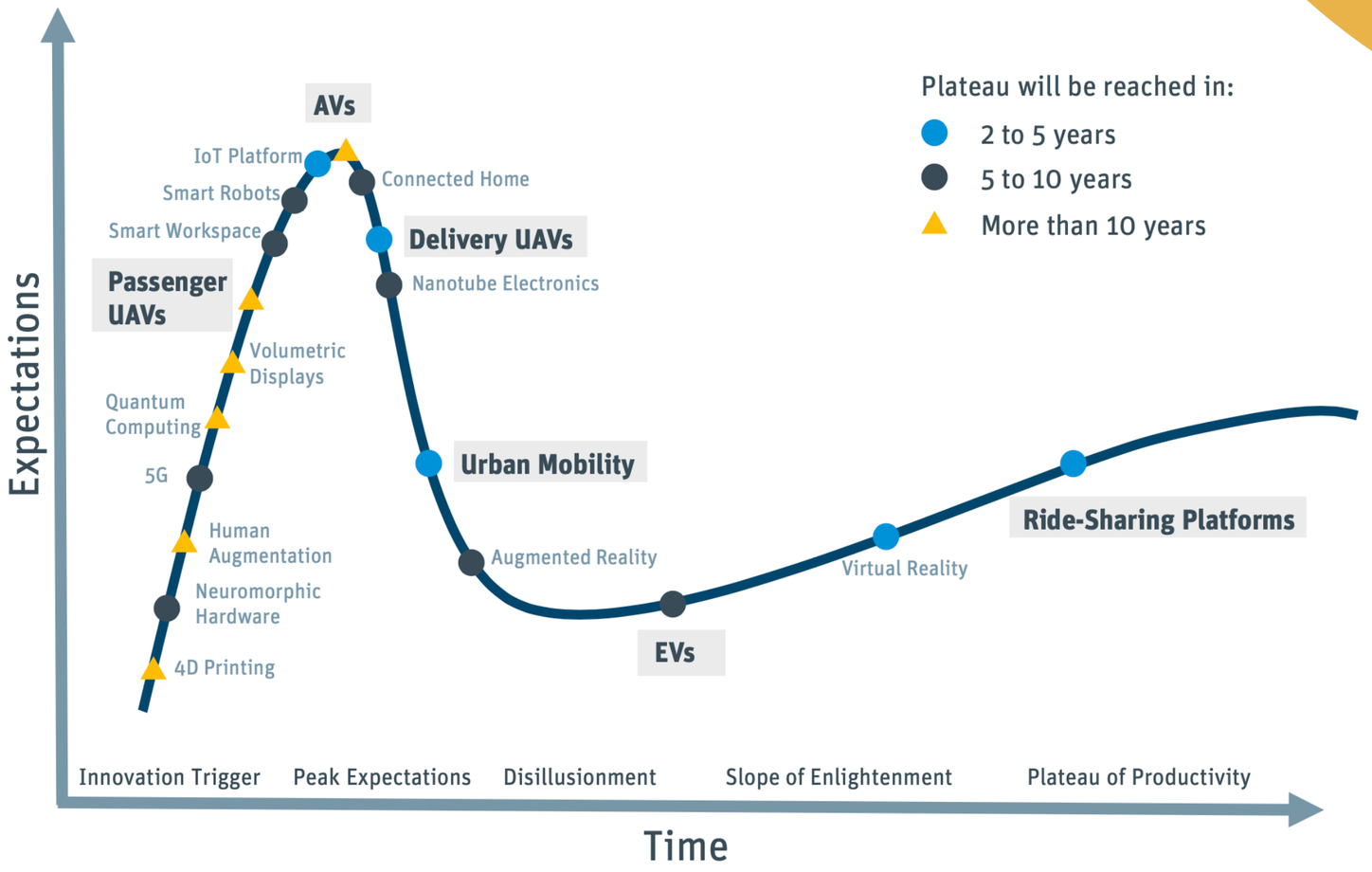
MOBILITY ADOPTION

Picture this: a city where your **commute** is not just a means of getting from point A to point B, but an **experience** in itself—a seamless blend of safety, efficiency, sustainability, and innovation. This isn't just a utopian dream; it's the vision for the mobility ecosystems of tomorrow.

By 2025-2030, electric vehicles (EVs) will dominate new car sales, while **autonomous Level 3-4 vehicles** operate in controlled environments. Mobility-as-a-Service (MaaS) will integrate ride-sharing, public transit, and micro-mobility, making car ownership less essential. AI-driven traffic management and hydrogen-powered heavy transport will also scale.

Between **2030-2035**, fully autonomous vehicles (Level 4-5) will roll out in cities, along with urban air mobility (eVTOL taxis). Smart infrastructure, connected transport, and vehicle-to-grid (V2G) charging will become standard.

By **2035-2040**, private car ownership will decline sharply as **self-driving, AI-optimized transport** takes over. Hyperloop, drone deliveries, and near-zero-emissions cities will redefine mobility. However, regulatory frameworks, infrastructure investment, and public trust will determine how fast this future arrives. The shift is inevitable—those who prepare now will shape the future of transportation.



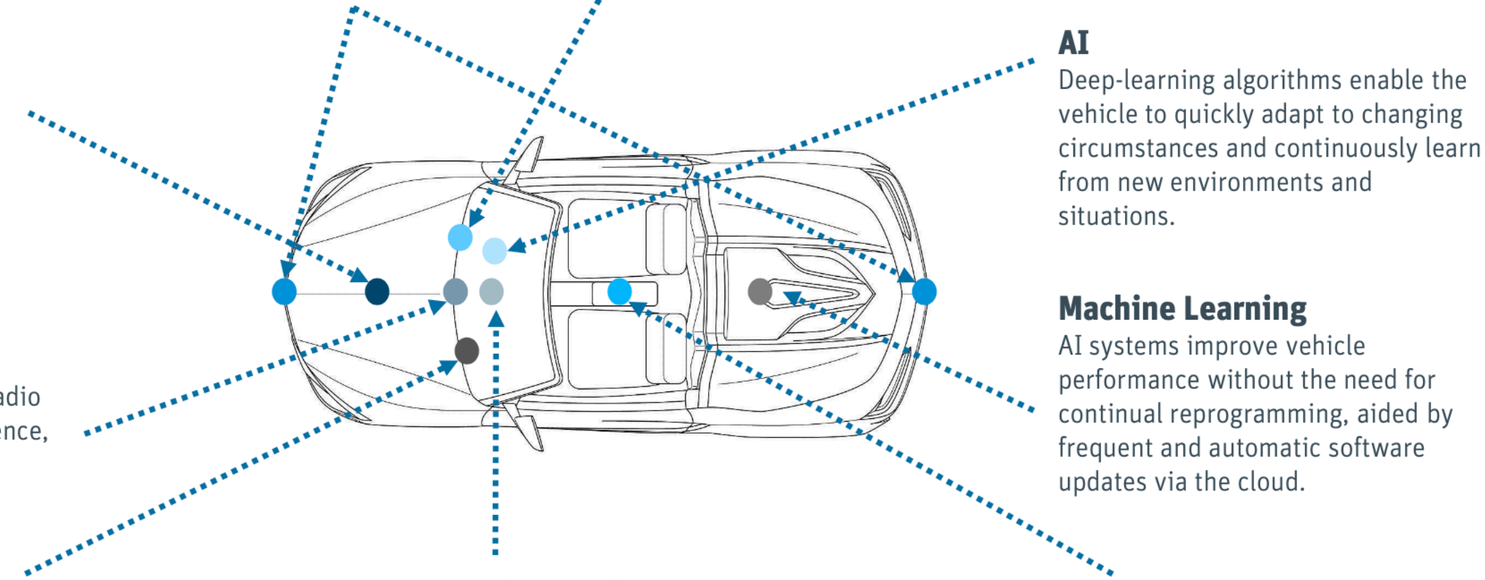
Source: Gartner and SVB analysis

THE TECHNOLOGY OF AUTONOMY

Sensors and Cameras
Data about the vehicle's surroundings are captured by onboard sensors and cameras, allowing precise movements in environments that are constantly changing.

Cloud-Based Data Processing
Real-time telemetric data is hosted on cloud-based servers, allowing the vehicle to process vehicle speeds and surrounding-car proximity.

Connectivity
All the systems onboard are networked, communicating with other vehicles and surrounding objects. This allows for adjustments due to changing weather or road conditions.



AI
Deep-learning algorithms enable the vehicle to quickly adapt to changing circumstances and continuously learn from new environments and situations.

Millimeter-Wave Radar
Millimeter-wave radar uses radio waves to determine the presence, distance and velocity of surrounding objects.

Machine Learning
AI systems improve vehicle performance without the need for continual reprogramming, aided by frequent and automatic software updates via the cloud.

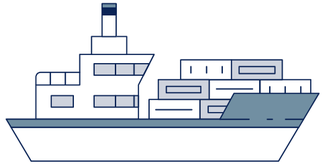
LiDAR
Light Detection and Ranging technology senses traffic and vehicle brake lights. These sensors can even detect road conditions based on changes in the amount of light being detected on the road.

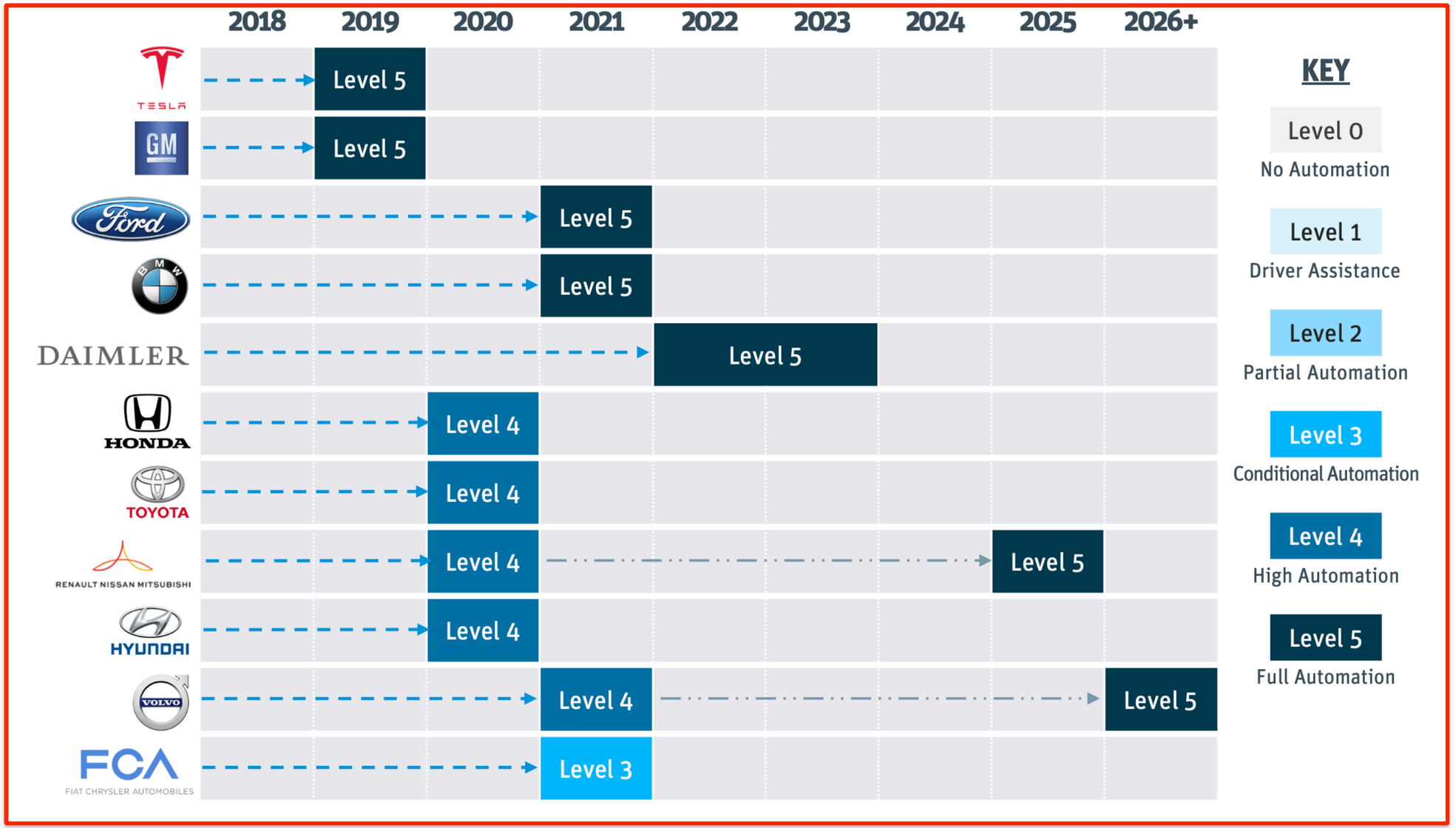
High-Performance GPS
Geosynchronous and low-earth orbit satellites track location down to a few feet, helping guide the vehicle to its destination.

Local Data Processors
Onboard computers with specialized chipsets and software automatically perform real-time calculations with terabytes of data, enabling critical decision-making in milliseconds.

Source: MIT Technology Review and SVB analysis

AUTONOMY TIMEFRAME





Source: MIT Technology Review and SVB analysis


RIDE OF THE FUTURE

RIDE OF THE FUTURE WILL BE SUSTAINABLE

The modern mobility landscape faces twin challenges: scalability—ensuring systems can accommodate growing urban populations and increasing demand—and sustainability—reducing environmental impact and fostering long-term viability. Solutions must align with technological, social, and economic considerations.

In 2040, the world of mobility will not just look different—it will *feel* different. Cities will hum with electric pods weaving through the streets, guided by algorithms that know where you're going before you do. Roads will be shared by human drivers, AI-driven vehicles, and micro-mobility solutions, each seamlessly interacting with the other. The air will be cleaner, not because we finally curbed our bad habits, but because we had no other choice.

The shift will be powered by three undeniable forces: **decarbonisation, digitalisation, and decentralisation**. Fossil fuels, once the uncontested rulers of the road, will be relics. The electric revolution, once dismissed as wishful thinking, will be fully realised, but electricity won't be the only game in town. Hydrogen, biofuels, and even solar-powered vehicles will carve out their spaces in the mobility ecosystem. But the real transformation won't just be in how we power our vehicles—it'll be in how we **think** about mobility itself. Ownership will be a quaint memory, replaced by subscription-based, on-demand networks of transport. The idea of a single person sitting in traffic inside a two-ton metal box? Absurd.

DECARBONIZATION

In the face of climate change and its increasingly visible impacts, decarbonisation has emerged as one of the most vital strategies for mitigating environmental harm. The term *decarbonisation* refers to the process of reducing carbon dioxide (CO2) emissions—primarily from fossil fuels—by transitioning to low-carbon and renewable energy sources. It is an essential component of global efforts to achieve net-zero emissions, limit global warming, and build a more sustainable future.

What is Decarbonisation?

Decarbonisation is a multi-faceted process aimed at reducing the carbon footprint of industrial activities, energy systems, and daily life. The primary goal is to lower the amount of CO2 released into the atmosphere, which is the leading greenhouse gas contributing to climate change. While decarbonisation is most closely associated with the energy sector, it extends beyond just reducing emissions from power plants; it encompasses a wide range of actions aimed at transforming how societies produce and consume energy, transport goods and people, and manufacture products.

Why Decarbonisation Matters

- **Climate Change Mitigation**: The most urgent reason for decarbonisation is the need to combat climate change. The Intergovernmental Panel on Climate Change (IPCC) has made it clear that to limit global warming to 1.5°C above pre-industrial levels—a target set by the Paris Agreement—global CO2 emissions must be reduced to net-zero by 2050. Decarbonisation plays a key role in achieving this goal.
- **Health Benefits**: Reducing CO2 emissions also reduces other pollutants, such as particulate matter and nitrogen oxides, which contribute to air pollution. By transitioning away from fossil fuels, especially coal and diesel, air quality improves, leading to better health outcomes, fewer respiratory diseases, and fewer premature deaths.
- **Energy Security**: Decarbonisation involves the increased use of renewable energy sources like solar, wind, and hydropower. This reduces reliance on imported fossil fuels, which can be subject to volatile prices and supply disruptions, improving national energy security and price stability.
- **Economic Transformation**: The transition to a green economy opens up new opportunities for innovation, job creation, and investment. From renewable energy infrastructure to green technologies in manufacturing, construction, and transportation, decarbonisation can drive economic growth, improve energy efficiency, and reduce the cost of climate-related disasters in the long run.

Electrification: The transportation sector, especially cars, trucks, and buses, is a major source of emissions. Transitioning from internal combustion engine vehicles to electric vehicles (EVs) powered by renewable energy is a key aspect of decarbonising transportation.

Public Transit and Active Transport: Reducing the overall demand for cars by investing in public transportation, cycling infrastructure, and pedestrian-friendly cities can further reduce emissions.

RIDE OF THE FUTURE WILL BE SUSTAINABLE

ELECTRIC VEHICLES (EVS)

Electric Vehicles (EVs) and vehicles powered by green hydrogen represent two leading technologies in the transition to sustainable mobility. Each has distinct advantages and challenges that determine their feasibility, scalability, and timeline for widespread adoption.

Pros:

Energy Efficiency: EVs are highly efficient, converting 60-80% of electrical energy from the grid to motion compared to 20-30% for internal combustion engines.

Mature Infrastructure: Charging networks for EVs are expanding rapidly, making adoption easier.

Lower Operating Costs: EVs have fewer moving parts, leading to reduced maintenance and operational costs.

Reduced Emissions: When charged with renewable energy, EVs produce zero emissions.

Wide Variety of Options: Available in passenger, commercial, and even performance models.

Cons:

Range Anxiety: Limited driving range and long charging times can be a concern for long-distance travel.

KEY PLAYERS

Battery Challenges: Lithium-ion batteries require rare earth materials, leading to supply chain vulnerabilities, high costs, and environmental concerns.

Grid Dependency: Increased EV adoption places pressure on electricity grids, requiring significant upgrades to support demand.

End-of-Life Concerns: Battery recycling and disposal are challenging, though improvements are underway.

EV ECOSYSTEM

Research and Development (R&D): Driving innovation through the development of cutting-edge technologies and efficient solutions.

Battery Production: Ensuring the creation of high-performance and durable batteries through optimized production processes.

EV Manufacturing: Assembling vehicle components into a final product, with a strong emphasis on quality control and lean manufacturing principles.

Charging Infrastructure Development: Enabling EV adoption by ensuring convenient and accessible charging options through strategic deployment.

KEY CHALLENGES

Distribution and Sales: Facilitating the timely delivery of vehicles to consumers through an efficient network of distribution channels.

Installation and Commissioning of Charging Stations: Enhancing customer convenience by enabling seamless access to charging infrastructure.

Customer Support and After-Sales Services: Maintaining customer satisfaction and loyalty through exceptional support and value-added services.

Timeline for Ubiquity:

EVs are on a rapid growth trajectory and are expected to dominate personal and light commercial vehicle markets by the 2030s. Many countries have announced bans on internal combustion engine (ICE) vehicles, accelerating adoption.

KEY OPPORTUNITIES

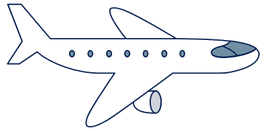
CHALLENGES: The road to clean mobility isn't without potholes:

- **Raw Materials** – Lithium, cobalt, nickel. The demand for EV batteries is fueling new geopolitical conflicts.
- **Infrastructure** – Charging stations, hydrogen refueling networks—there aren't enough of them yet.
- **Regulation** – Some governments accelerate change, others hold it back. The pace of transformation is uneven.

But the **OPPORTUNITIES** are immense:

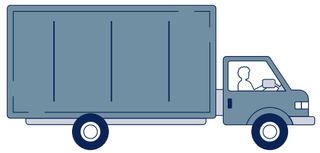
- **Battery Recycling** – Companies like Redwood Materials and Northvolt are turning dead batteries into new ones.
- **Grid Integration** – EVs won't just consume energy; they'll store and return it to the grid.
- **Emerging Markets** – Africa, India, Latin America—places leapfrogging directly to sustainable transport.

POWERING MOBILITY



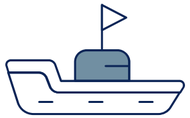
BATTERIES

Electric Vehicles (EVs) have won the first battle. Lithium-ion technology reigns, but solid-state batteries (lighter, denser, faster-charging) are around the corner. Companies like QuantumScape and Toyota are leading the charge.



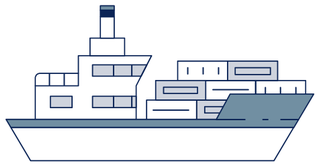
HYDROGEN FUEL CELLS

The underdog. Perfect for trucks, ships, and planes. Toyota's Mirai, Hyundai's Nexo, and Daimler's hydrogen freight trucks show promise. But infrastructure? That's still a problem.



SOLAR

Not quite there yet, but companies like Aptera and Lightyear are flirting with the idea of self-sustaining vehicles powered by the sun.



E-FUELS

Porsche and Airbus are betting on synthetic fuels as a transition solution, using captured CO2 and renewable electricity to create a gasoline alternative.


RIDE OF THE FUTURE WILL BE SMART

RIDE OF THE FUTURE WILL BE SMART

KEY TRENDS

AI-Powered Traffic Systems – Cities will use real-time data to manage congestion, reduce travel times, and improve safety.

Autonomous Fleets – Self-driving taxis, delivery bots, and freight trucks will dominate urban and long-haul transport.

Mobility-as-a-Service (MaaS) – People will subscribe to seamless transport services instead of owning vehicles.

5G & Edge Computing – Vehicles will communicate instantly with infrastructure, pedestrians, and other vehicles for real-time decision-making.

Hyperloop & High-Speed Rail – Cities will be connected by ultra-fast, low-emission transport systems, reducing reliance on air travel.

Drone & Air Mobility – Personal aerial vehicles, cargo drones, and urban air taxis will change how we move across short and medium distances.

KEY PLAYERS

Electric Batteries (Lithium & Solid-State)
– The **backbone of smart urban mobility**, used in passenger EVs, robo-taxis, and e-scooters.
– Solid-state batteries will **increase energy density and reduce charging times** to minutes.

Hydrogen Fuel Cells
– Essential for **heavy transport**, aviation, and long-haul shipping, where batteries alone are impractical.
– Toyota, Hyundai, and Airbus are leading developments in fuel-cell technology.

Wireless & Inductive Charging
– Roads and parking spaces will have built-in **wireless charging pads**, eliminating the need for cables.
– **Dynamic charging lanes** will allow EVs to recharge while driving.

Solar-Powered Vehicles
– Solar integration will provide **supplementary energy**, extending range and reducing dependency on external charging.
– Companies like Lightyear and Aptera are pioneering solar-assisted EVs.

AI-Optimized Energy Management
– **Smart grids** will dynamically allocate power where it's needed most,– AI will predict and **optimize charging schedules**, reducing strain on the grid during peak hours.

KEY CHALLENGES

Cybersecurity & Data Privacy–The more connected mobility becomes, the greater the risk of hacking and cyberattacks on vehicles and infrastructure.
– Who owns the data? Should private companies or governments control mobility data, and how will they protect user privacy?

Infrastructure Overhaul–Roads, bridges, and highways will need **smart sensors, adaptive lanes, and high-speed charging stations**– a massive undertaking.
– Cities designed for traditional cars must be **restructured for autonomous transport**.

Regulatory Barriers–Governments will struggle to keep pace with rapid technological advancements, delaying widespread adoption.
– Legal frameworks must evolve to address **liability in autonomous accidents**, AI-driven decision-making, and international transport policies.

Equitable Access & Cost–Will smart mobility be **affordable for all**, or will it primarily benefit wealthy, tech-savvy urban populations?
– How do we prevent rural and lower-income communities from being left behind?

KEY OPPORTUNITIES

Personalized Travel–AI will **predict and optimize** routes, ensuring minimal wait times and delays.
Drastic Reduction in Traffic Accidents–AI-driven mobility will **eliminate human error**, which currently causes **94% of accidents**.
–Emergency response systems will be integrated directly into vehicles, instantly notifying authorities of accidents or medical emergencies.

Smart Cities & Greener Urban Spaces
–With fewer **privately owned** vehicles, cities can reclaim **parking lots and congested roads** for green spaces, pedestrian zones, and smart infrastructure.
– Reduced congestion means lower **carbon emissions** and cleaner air.

New Economic & Business Models
–The **rise of autonomous logistics** will redefine e-commerce, making same-day and even same-hour deliveries the norm.
– Urban air mobility will create a **multi-billion-dollar industry** in air taxis and drone-based deliveries.

RIDE OF THE FUTURE WILL BE SMART

KEY TRENDS

CONNECTIVITY

Imagine a world where every vehicle, road, and transport hub **talks to each other in real time**. Connectivity will be the backbone of smart mobility, enabling data to flow seamlessly between all elements of the transport ecosystem.

What Will Be Connected?

- **Vehicles to Infrastructure (V2I)** → Cars, buses, and trucks will communicate with traffic lights, smart roads, and charging stations to optimise flow and prevent congestion.
- **Vehicle to Vehicle (V2V)** → Cars will exchange information about speed, location, and hazards, allowing them to predict and react to potential accidents before they happen.
- **Vehicle to Everything (V2X)** → This includes interactions with pedestrians (smart crosswalks), cyclists, weather sensors, and even emergency services.
- **Cloud-Based Mobility Platforms** → Transportation will be centrally managed using AI-driven cloud systems that analyse traffic patterns, suggest better routes, and balance demand across different transport modes.

Benefits of Connectivity

Eliminates Traffic Jams , Enhances Safety, Reduces Carbon Emissions, Creates Seamless Mobility-as-a-Service (MaaS)

AUTOMATION

Automation is the second pillar of smart mobility. By 2040, most transport will be **autonomous**—whether it's self-driving taxis, robo-buses, or AI-powered cargo trucks. Human error, which is responsible for 94% of road accidents today, will become a thing of the past.

How Automation Will Work

- **Self-Driving Vehicles (SAE Level 5 Autonomy)** → These will handle navigation, acceleration, braking, and decision-making without any human intervention.
- **Autonomous Public Transport** → AI-powered buses and shuttles will adjust their routes in real-time based on passenger demand and road conditions.
- **Automated Freight & Logistics** → Autonomous delivery vehicles, drones, and self-driving trucks will operate **24/7**, cutting costs and making supply chains more efficient.
- **AI-Driven Traffic Control** → Instead of human traffic controllers or static signals, **machine learning algorithms** will adjust road conditions dynamically, reducing wait times at intersections.

RIDE OF THE FUTURE WILL BE SMART

KEY TRENDS

INTELLIGENCE

If **connectivity** is the nervous system and **automation** is the body, **intelligence** is the brain. This refers to the AI-driven decision-making systems that will make mobility truly "smart."

How Intelligence Works in Smart Mobility

- **Predictive AI & Big Data Analysis** → Mobility systems will analyse **historical travel patterns, weather conditions, and live data** to anticipate and prevent problems before they happen.
- **Machine Learning Traffic Control** → Instead of fixed traffic lights, AI will adjust signals in real-time based on actual road usage.
- **Personalised & Context-Aware Transport** → AI will learn from user preferences, automatically **choosing the fastest, cheapest, or most sustainable travel option** for each person.
- **Smart Energy Management** → AI will optimise energy use, Benefits of AI-Driven Intelligence

Eliminates Inefficiencies → AI removes wasted travel time, making every trip **faster and smoother**.

Adapts to User Behaviour → Your smart assistant will pre-book transport based on your calendar and habits.

Optimises Energy Usage → AI will balance electric vehicle charging demand to prevent blackouts and maximise grid efficiency.

Improves Emergency Response → AI will instantly reroute emergency vehicles, clearing the way for ambulances and fire trucks.

AUTOMATION

The final pillar of smart mobility is **speed**—not just in terms of velocity, but in **efficiency, response times, and decision-making**. The goal is **instantaneous movement** with **zero friction**.

Key Speed Features:

- **Hyperloop & High-Speed Rail:** Near-supersonic travel will replace long-haul domestic flights, cutting **city-to-city travel times by 80%**.
- **Supersonic & Hypersonic Air Travel:** Aircraft capable of flying **5X the speed of sound** will enable **same-day intercontinental travel**.
- **Maglev & Hyper-Connected Urban Transport:** Cities will be redesigned with **magnetic levitation (maglev) transit**, reducing travel time within metro areas to **mere minutes**.
- **On-Demand Mobility-as-a-Service (MaaS):** AI-powered ride-sharing platforms will **predict demand** and dispatch **autonomous vehicles instantly**.

Impact of Speed:

Reduces long-haul travel times from hours to minutes.
Eliminates waiting with instant, on-demand transport.
Increases productivity by minimising wasted travel time.

HOW DO WE PREPARE?

MOBILITY OF THE FUTURE 2040

AREAS OF FOCUS

INFRASTRUCTURE

- **Smart Roads & Cities**: Develop IoT-enabled roads, smart traffic signals, and AI-powered urban planning to reduce congestion and improve efficiency.
- **EV & Hydrogen Charging Networks**: Expand fast-charging and hydrogen refuelling stations powered by renewable energy.
- **Public & Micro-Mobility Integration**: Design urban spaces that support walking, cycling, e-scooters, and seamless public transport connectivity.
- **Autonomous Vehicle-Friendly Zones**: Create dedicated lanes and infrastructure that support self-driving vehicles.

REGULATIONS

- **Autonomous Vehicle Policies**: Establish clear legal frameworks for self-driving vehicles, including liability and insurance models.
- **Emission Reduction Targets**: Enforce stricter CO_2 emission laws and incentivise zero-emission vehicle adoption.
- **Data Privacy & Governance**: Regulate how mobility data is collected, stored, and shared securely.
- **Public-Private Partnerships**: Foster collaboration between governments, startups, and corporations to accelerate mobility innovation.

SYSTEMS

- **Mobility-as-a-Service (MaaS)**: Develop integrated digital platforms that combine ride-sharing, public transit, and micro-mobility into a single service.
- **AI-Driven Traffic Management**: Use real-time AI analysis to optimise routes, reduce travel time, and lower emissions.
- **Decentralised Transportation Networks**: Leverage blockchain for secure transactions in ride-sharing, carpooling, and logistics.
- **On-Demand & Shared Mobility**: Reduce personal vehicle ownership by expanding car-sharing, ride-hailing, and subscription-based transport.

TECHNOLOGY

- **AI & Machine Learning in Transport**: Enhance predictive analytics for vehicle maintenance, traffic flow, and personalised mobility experiences.
- **5G & V2X Communication**: Enable real-time connectivity between vehicles, infrastructure, and pedestrians for safer mobility.
- **Autonomous Vehicles & Robotics**: Scale self-driving cars, drones, and robotic delivery systems for efficiency.
- **Sustainable Vehicle Materials**: Innovate in recyclable materials and battery technology to reduce the environmental impact of vehicle production.

SAFETY

- **Autonomous Safety Protocols**: Implement rigorous testing and AI fail-safe systems to prevent accidents.
- **Cybersecurity in Connected Vehicles**: Protect self-driving and connected vehicles from hacking and data breaches.
- **Ethical AI Decision-Making**: Ensure that AI in autonomous vehicles makes ethical choices, especially in accident scenarios.
- **Inclusive Mobility Design**: Ensure transportation systems are accessible to all, including the elderly and disabled.

UPSKILLING

- **Future Workforce Development**: Train professionals in AI, robotics, cybersecurity, and autonomous vehicle engineering.
- **Transition Support for Traditional Auto Workers**: Reskill workers from conventional vehicle manufacturing to electric and AI-powered mobility industries.
- **Data Science & Transportation Analytics**: Equip workers with skills to manage smart transportation systems and data-driven mobility services.
- **AI Ethics & Policy Experts**: Develop expertise in regulating and managing ethical AI decision-making in transport.

ABOUT LUMINA

Foster A Culture Of Innovation

Lumina is a cutting-edge futures think tank dedicated to helping governments and organisations bridge the gap between the present and the rapidly evolving landscape of trends and technology. Our diverse portfolio includes collaborations with clients such as the South African Police Service, educational institutions like UNISA, and businesses tackling some of the world's toughest challenges.

At Lumina, we empower our clients to navigate uncertainty with confidence, seize emerging opportunities, and design sustainable futures. By combining strategic advisory services with futurist expertise, we provide the tools and insights needed to thrive in an era of rapid change.

LUMINA

SOLVE BIGGER PROBLEMS, LEAD WITH FORESIGHT & INNOVATE WITH PURPOSE