

The road ahead: Autonomous vehicle manufacturing and adoption in the GCC

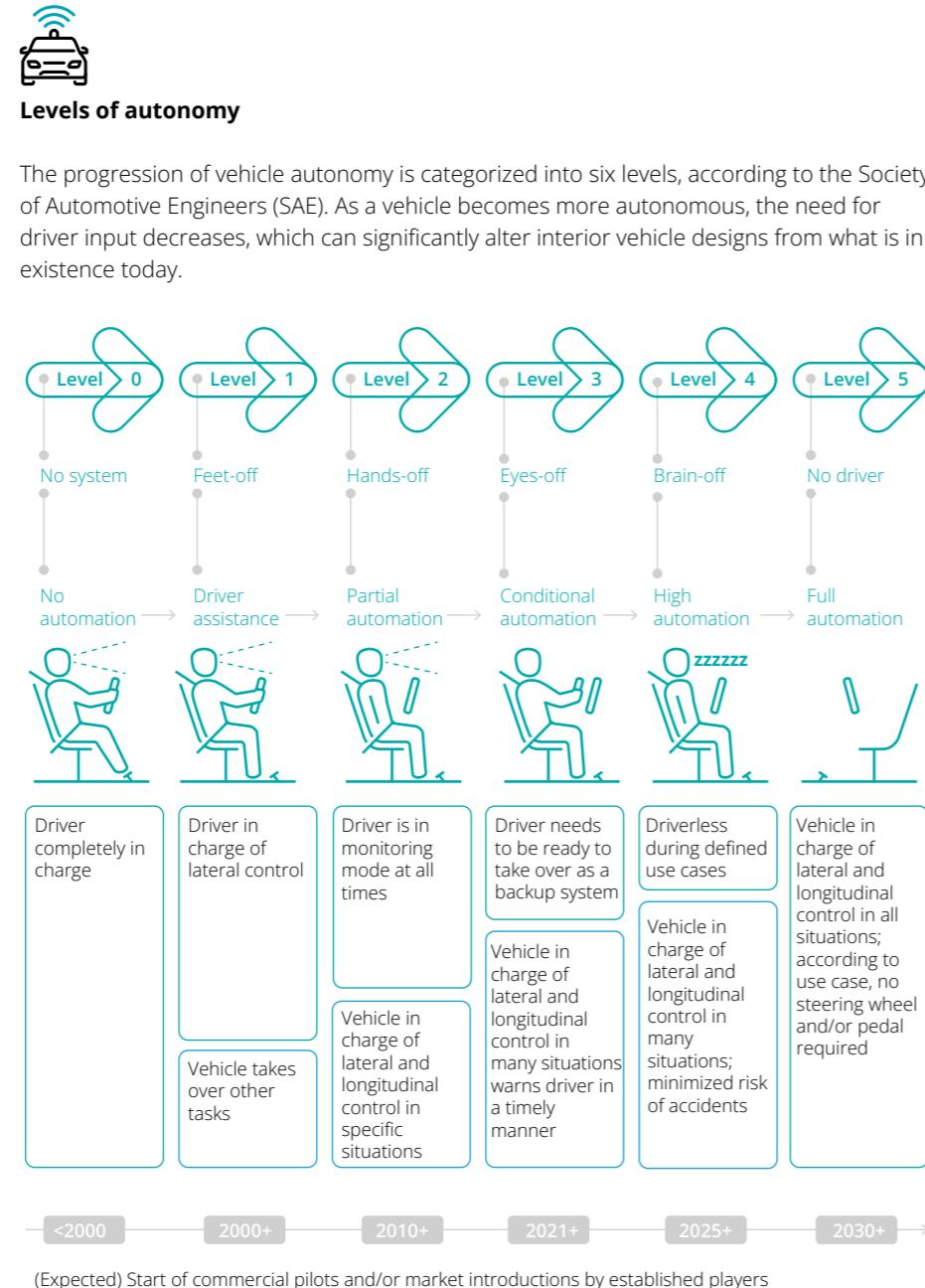


Autonomous vehicles (AVs) are bound to revolutionize the transportation and mobility landscape, integrating advanced technologies to navigate and operate without human intervention. These vehicles rely on a combination of custom high-definition (HD) maps, artificial intelligence (AI), on-board sensors, cameras, and connectivity modules to interpret the external environment and make driving decisions in real time.

Autonomous vehicles rely on a complex mix of sensors, computing power, and AI to navigate their environment. Key components such as light detection and ranging (LiDAR), radar, cameras, and high-performance chips have seen rapid technological advances in recent years, improving both their accuracy and reliability. At the same time, costs have continued to decrease—LiDAR costs, for example, have fallen from US\$75,000/unit a decade ago to under US\$100 today.¹ Similarly, AI computing costs have declined with more efficient chips and better software optimization, supporting an improvement in AV economics.

Regional interest in autonomous mobility systems is clear, with several initiatives being pursued:

- Saudi Arabia aims to have 15% of public vehicles in Riyadh operating autonomously by 2030 as part of Vision 2030's smart mobility initiatives.²
- In the UAE, Dubai has committed to making 25% of all transportation trips autonomous by 2030, with Roads and Transport Authority (RTA)-backed initiatives, such as autonomous taxis and delivery bots.³
- Ahead of the 2022 FIFA World Cup, Qatar deployed self-driving electric shuttles, highlighting a potential push for broader AV integration. In parallel, the Ministry of Transport has issued an autonomous vehicle strategy with a 5-year roadmap.



Source: Deloitte research, SAE International 2014

Today, over 90% of new cars are equipped with some form of advanced driver assistance systems (ADAS), mainly at L1-L2 levels.⁴ Since 2021, however, global car making giants, including Mercedes-Benz⁵ and BMW,⁶ have announced a shift to Level 3. Level 4 and 5 vehicles are still at the experimentation stage and are being launched in extremely controlled environments due to the required regulations, driving code updates, and the multiple sensors required in road infrastructure.

Autonomous vehicle manufacturing clusters opportunities

AV manufacturing relies on a global, technology-centric supply chain, blending traditional auto suppliers with new technology players. Unlike conventional vehicles, a significant portion of an AV's value comes from its electronics and software content. The manufacturing complexity of AVs also varies by level, with higher autonomy requiring more sophisticated integration between hardware, software, and safety systems. Manufacturing at L4 and L5 (high/full automation) demands custom built platforms, requiring new supply chains and dedicated AV production plants.

Geographically, the AV component supply chain spans multiple continents. Sensors may be designed in the US or Europe, manufactured in East Asia, and then integrated into vehicles in factories scattered worldwide. Key semiconductor components often come from Taiwan or South Korea; LiDAR and camera units might be produced in North America, Europe, or China. Automakers must manage this complexity and ensure quality and reliability of these critical parts. Supply chain resilience (multi-sourcing, inventory management) has also become a strategic priority, especially after recent global disruptions and trade wars. These challenges have also pushed certain producers and suppliers to look for alternative manufacturing locations with good logistics and global connectivity, aiming to serve local/regional demand while also mitigating global trade challenges.

Recent examples of incentivizing local production of AV components, such as the US CHIPS Act to localize semi-conductor production⁷ and Saudi Arabia's investment of US\$6 billion in EV battery metals and a steel plant to support its nascent EV industry,⁸ demonstrate the strategic importance of controlling key interfaces in the AV supply chain.

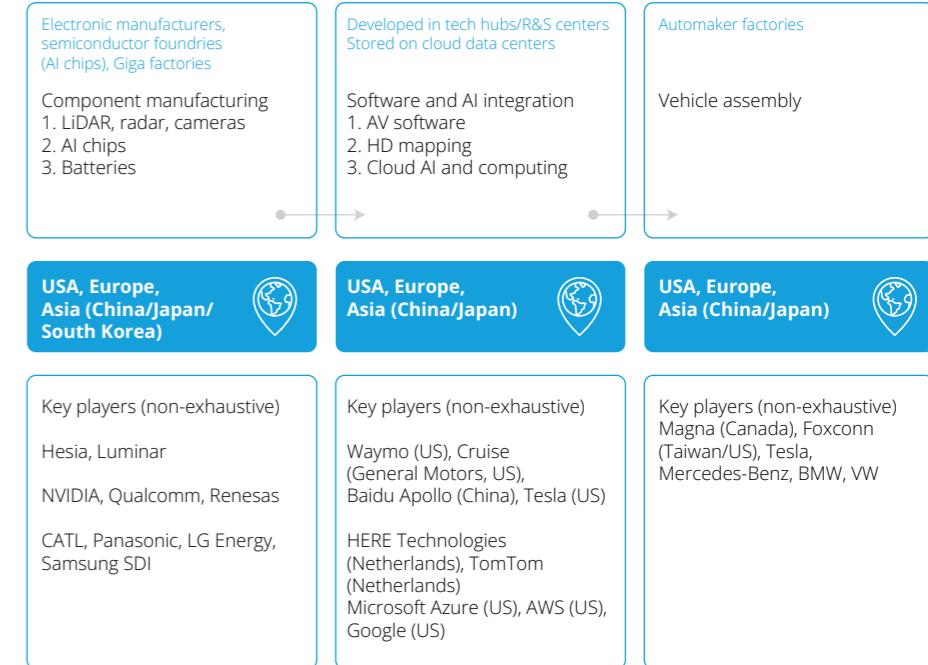


Figure 2: AV manufacturing lifecycle: Stages, hubs, and key players

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A GCC perspective: Readiness and opportunities in AV manufacturing

GCC countries are newcomers to automotive manufacturing, but recent investments are building a foundation for a natural progression toward autonomous vehicles. Historically, the region imported all vehicles, with minimal local production. That is now changing, especially in Saudi Arabia. In 2022, the Public Investment Fund (PIF) launched Ceer, the Kingdom's first domestic electric vehicle brand. Ceer, a joint venture with Foxconn and BMW as technology partners, is developing a manufacturing facility in King Abdullah Economic City (KAEC) with a US\$96 million investment. This plant aims to produce a range of electric sedans and SUVs by 2025,⁹ and being an all-new facility, it is being designed with advanced automation and potential future AV integration in mind.

In parallel, Saudi Arabia has attracted Lucid Motors to build its first international EV factory in the Kingdom. Opened in 2023 at KAEC, Lucid's plant can assemble 5,000 vehicles per year initially, with expansion plans up to 155,000 units annually once fully operational.¹⁰ This makes it the country's first-ever car manufacturing plant, a milestone toward establishing a domestic automotive industry. While Lucid's current models are premium electric cars (not fully autonomous vehicles), the presence of a modern electric vehicle (EV) assembly facility (and associated supplier park) is a strategic asset as it provides a base of trained workers, supply chain logistics, and production know-how that could be leveraged to produce AVs or AV-ready vehicles in the future.

Beyond electric cars, the GCC has also started hosting small-scale assembly of special-purpose vehicles related to autonomy. For example, Dubai and Abu Dhabi have piloted autonomous shuttles and pods (often imported but

assembled or tested locally) in controlled environments such as Dubai Expo 2020¹¹ and Masdar City.¹² While these pilots are limited, they have led to the development of research and development (R&D) and testing infrastructure.

Governments in the Middle East, eyeing economic diversification, are heavily incentivizing advanced industries such as EVs and autonomous technologies. Saudi Arabia's Vision 2030 explicitly targets the automotive sector as a growth industry, with goals to locally produce up to 500,000 vehicles annually by 2030 (raised from an earlier target of 150,000). To achieve this, Saudi authorities are offering attractive incentive packages: access to cheap industrial land, soft loans, and co-investment via the PIF.¹³ The Kingdom requires high local content and is prepared to be an anchor customer (for instance, committing to having 30% of cars in Riyadh be electric or autonomous by 2030,¹⁴ ensuring local demand). Saudi Arabia is also establishing special economic zones focused on advanced manufacturing such as NEOM's Oxagon, which promises streamlined regulations and infrastructure for next-generation mobility systems.

The UAE has created designated test beds – Dubai's RTA and Abu Dhabi's Department of Municipalities have both opened test tracks for self-driving vehicles. Notably, Abu Dhabi's Masdar City is evolving into a hub for AV innovation; it was chosen to host the new Smart and Autonomous Vehicle Industries (SAVI) cluster, which provides dedicated test zones for autonomous air, land, and sea vehicles. The SAVI cluster, expected to contribute US\$24-32 billion to the UAE economy alone,¹⁵ brings together automakers, technology players, and researchers, offering state-of-the-art facilities and a sandbox regulatory environment to experiment with AVs with the strong backing of the government.

Through the Abu Dhabi Investment Office (ADIO), the UAE is similarly offering generous incentives: financial grants and tax breaks, R&D support, and an enabling

regulatory environment with fast-track licensing for AV testing. The UAE has even granted a preliminary national license to a foreign AV operator (China's WeRide) to start road testing its robo-taxis¹⁶ – a first in the Middle East. This proactive regulatory stance, combined with initiatives like digital mapping of cities (Dubai is mapping its roads in detail for AV readiness¹⁷), signals to AV companies that the government will be a facilitator, not a barrier, to AV deployment. Additionally, there are infrastructure incentives across GCC countries: large-scale investments in 5G networks¹⁸ (for vehicle connectivity), smart road systems in Saudi Arabia (Saudi Road Code with 'vehicle-to-everything' road-side units being installed) and planned charging networks for EVs (5,000 fast chargers in Saudi Arabia by 2030¹⁹ which support electric AV operations. In short, GCC governments are deploying all elements – direct investment to regulatory sandboxes – to jump-start local manufacturing of future vehicles, including autonomous ones. These incentives significantly raise the region's attractiveness as a destination for AV industry investment.

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Comparative advantage vs. other global hubs

When considering setting up AV manufacturing, companies will compare the GCC with established auto-technology hubs in the US, Europe, and East Asia. However, the Gulf region offers some unique advantages. Capital and financial support is one; few places globally can match the scale of government-backed funding available for strategic projects. A company that might struggle to find subsidies elsewhere could receive substantial support and guaranteed purchase contracts in the GCC (as seen with Lucid²⁰ and Ceer²¹ deals). The GCC also boasts relatively low energy and utility costs – important for energy-intensive manufacturing and for operating fleets of electric AVs (electricity and industrial fuels are subsidized or cheaper due to local oil and gas resources). Additionally, the region's geographic location can be an advantage; manufacturing in the Gulf can serve demand in the Middle East and potentially Africa or South Asia, markets that global Original Equipment Manufacturers (OEMs) sometimes underserve from distant factories. Modern port infrastructure, such as Jebel Ali Port (Dubai, UAE), King Abdulaziz Port (Dammam, Saudi Arabia), and Hamad Port (Umm Al-Houl Free Economic Zone, Qatar), also makes it efficient to export finished vehicles or import components. Additionally, free trade zones (e.g., JAFZA, QFZ, KEZAD) can allow for duty-free importing of parts from Europe or Asia for assembly, and comprehensive economic partnership agreements between GCC and other countries can make exports more competitive.

However, the GCC must be weighed against the deep talent pool and supplier networks present in traditional auto hubs. Regions like Detroit, Germany's auto clusters (e.g. Baden Württemberg, Bavaria), or China's Pearl River Delta, all

major manufacturing bases, have tens of thousands of experienced automotive engineers and a dense network of tier-1 and tier-2 suppliers. The Gulf's automotive supplier base is currently small – most parts for assembly would need to be imported until a supplier ecosystem develops. This can increase lead times and costs unless offset by incentives. Labor is another mixed factor; while energy is cheap, skilled manufacturing labor is not abundant locally and typically involves either importing expertise or training new workers. Gulf countries do have extensive expatriate technical labor, but adroit vehicle engineering talent would need to be attracted from abroad. Labor costs for assembly operators in the GCC can be competitive (due to large pools of mid-skilled workers), but at the engineer and management level, costs may be higher to entice global experts to relocate.

Another factor to consider is domestic market size. The GCC, collectively, is not a large car market compared to the US, EU, or China. An automaker setting up production in the GCC will primarily be targeting export markets (Europe, Asia, etc.), unless the product is ultra-luxury (for which this region has strong demand²²) or tailored for local use cases (e.g., autonomous shuttles for planned cities, airport robots, etc.). Exporting globally from the GCC is feasible but would face tariff regimes unless trade deals/free trade agreements are in place – for instance, exporting cars to the EU or US might incur duties unless trade agreements are forged or trade tariffs are introduced elsewhere disrupting global trade. In contrast, manufacturing in regions like North America or China allows easier access to large local customer bases and existing trade pacts.

That said, the GCC's aggressive innovation agenda can make it a testbed and early adopter market for AV services, which in turn can attract manufacturing. The GCC benefits from a visionary mandate to establish itself as a mobility technology hub, competing for first-mover advantage

in several sectors, including autonomous mobility. For many companies however, the decision to localize manufacturing in the region hinges on whether the generous incentives and strategic partnership opportunities (similar to recent examples with PIF or ADIO) create a competitive advantage that justifies the challenges of building an industrial base from near scratch.

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Challenges to AV manufacturing in the GCC

Companies considering the GCC for an AV plant must navigate several challenges unique to the region which include:

- **Supply chain gaps:** As noted, nearly all components would initially need to be imported. The just-in-time supply chains common in auto manufacturing could be strained by distance and customs processes. Limited local suppliers also mean less flexibility and possibly higher inventory costs to buffer lead times.
- **Workforce and skills:** Building autonomous vehicles requires highly skilled software, electrical, and systems engineers, alongside trained production workers. The local workforce in GCC countries currently has limited experience in automotive manufacturing or AV systems which could be remedied at a cost.
- **Climate and testing:** The Gulf's extreme heat, dust, and humidity present engineering and testing challenges. AV sensors and batteries would need validation for high temperatures and sand exposure. While this can be an advantage as a testing condition, it may require additional hardening of components (cooling systems, sealed sensor housings) specifically for local climate, potentially adding cost or complexity to Gulf-manufactured units.
- **Regulatory fragmentation:** Each GCC country has its own regulations and certification processes for vehicles, so standards need to be harmonized. Further, long-term policy needs to remain stable across a 10-20-year time period.
- **Market uncertainty:** The timeline for wide deployment of AVs is still uncertain. The GCC's own adoption of autonomous vehicles – outside of controlled zones – will depend on public acceptance and legal frameworks that are still evolving.
- **Competition and technology transfer:** Global automakers may also be wary of producing their latest technologies in a new region due to IP protection or quality control concerns. Manufacturers would ensure that critical know-how (e.g.,



Strategic recommendations for AV manufacturers considering the GCC

Despite certain challenges, the GCC can be a compelling proposition with the right strategy. For companies looking to establish AV manufacturing in the region, the following recommendations apply:

- **Leveraging joint ventures and public-private partnerships:** Enter the market with a strong local ally. Partner with government-backed entities to share investment costs and navigate the local business environment. A joint venture can grant access to incentives and simplify the setup of facilities. For instance, aligning with the SAVI cluster in Abu Dhabi or Saudi's national automotive program will embed your project in the broader government vision, ensuring policy support. These partnerships may also help secure initial orders (e.g., government or ride-hail fleet purchases) to give the factory a baseline demand.
- **Start with Semi-Knocked Down (SKD)/Completely Knocked down (CKD) assembly and ramp up:** A phased approach can mitigate risk. Initially, consider CKD or SKD assembly, where vehicle kits or major modules are imported and merely assembled locally. This requires less complex infrastructure and helps train the workforce. Over time, increase localization – manufacture wiring harnesses, body panels, or eventually even sensor calibration locally as capabilities grow. This stepwise scaling lets the supply chain develop around the plant, aligning investments with proven demand.

self-driving software, chip designs) is safeguarded, even as they partner with local entities. There is also the competitive dynamic, where other countries (China, US) are heavily incentivizing local AV manufacturing too, so any GCC proposition must outmatch those to persuade a company to build there versus expanding at home.

• **Focus on niche AV products suited to the region:** Tailor the manufacturing plan to products that the GCC is especially interested in. For example, autonomous shuttles for smart cities, last-mile delivery robots for large campus complexes, or luxury autonomous vehicles for premium customers (a niche where GCC demand is strong). Producing a niche vehicle in the GCC that will be primarily used in GCC-led projects (like NEOM's city mobility or Dubai's autonomous taxi fleet) makes the local facility strategically important and less dependent on uncertain export markets.

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• **Capitalize on infrastructure and energy advantages:** Design a facility to exploit the region's modern infrastructure. For example, a plant in a coastal GCC city can be built adjacent to a port for seamless global supply intake and product export. Use abundant solar energy to power manufacturing with clean electricity at low cost, enhancing sustainability attributes (important if exporting to markets with carbon regulations). Also, engage with telecom providers rolling out 5G to ensure AV testing and data upload needs are fully supported.

• **Invest in local talent development:** Given the skill gap, it is important to establish training programs from day one. Set up an AV training academy in partnership with local universities or technical institutes. Offer internships and scholarships in automotive engineering, robotics, and AI to create a pipeline of GCC nationals and long-term residents capable to staff the plant and R&D centers. Additionally, bring experienced managers from established auto plants globally on fixed-term assignments to mentor local teams. Governments will likely co-sponsor such initiatives as it aligns with their job creation goals. Over time, a growing talent base will reduce reliance on foreign experts and engrain the company's roots in the region.

• **Ensure robust testing and validation in GCC conditions:** Turn the harsh climate into a feature by making the manufacturing facility a global center for hot-weather and desert testing. By co-locating a proving ground or simulation center, the plant can double as a validation site for all vehicles destined for warm-region deployments. Demonstrating that AVs produced in the GCC have been desert-proven can be a selling point for export markets with similar climates (e.g., India, Southeast Asia).

The global landscape of autonomous vehicle manufacturing is rapidly maturing with costs becoming more competitive and scaling primarily centered in traditional auto regions. The GCC is positioning itself ambitiously to join this advanced

manufacturing race, backed by significant capital and political will. Automakers and AV companies that effectively integrate global best practices with localized strategies in the Middle East can access a region eager to become a key hub for autonomous mobility. With strong partnerships and a phased approach, the GCC has the potential to shift from importing the vehicles of the future to manufacturing and even exporting them – establishing itself as a central player in high-tech vehicle production.

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