WE **DEFINE**
FUTURE IMPACT

P3 **BUSINESS
AS UNUSUAL**

ADAS
Market Intelligence
EU / NAR / CN

P3 ADAS Market Insights

We analyze global OEMs regarding their ADAS capabilities across the NAR, EU, and CN markets.

Created by:

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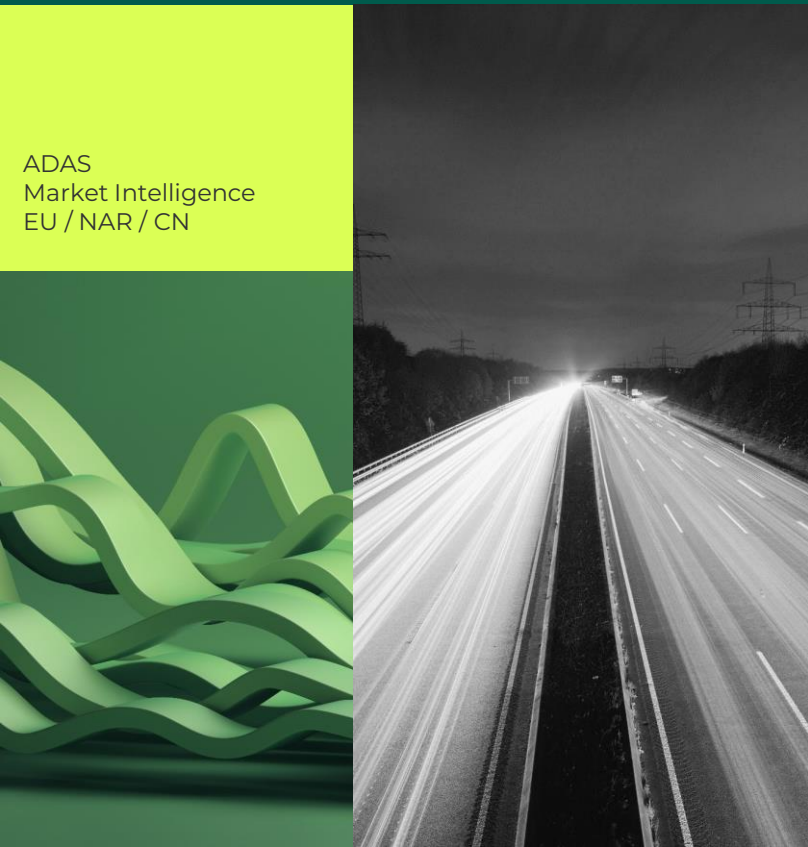Wilhelm-Wagenfeld-Str. 22
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P3 & P3 autonomous mobility.

General Introduction

At home in the outside world.

P3

■ Europe

Germany	Stuttgart	Serbia	Belgrad
	München		Subotica
	Wolfsburg	Romania	Cluj-Napoca
	Düsseldorf	Greece	Athen
	Berlin	Czech Republic	Prag
	Hamburg	Bulgaria	Sofia
	Osnabrück		Gabrovo
France	Paris		
	Toulouse		
Denmark	Kopenhagen		
Polen	Breslau		

■ Asia

China	Peking	Korea	Seoul
	Shanghai	Thailand	Bangok
	Shenzhen		

■ South America

Mexico	Mexico City
	Puebla
	Querétaro
	San Luis Potosi
Colombia	Cali

■ North America

USA	Charleston
	Detroit
	Greenville
	Dallas

Porftolio as unusual.

P3
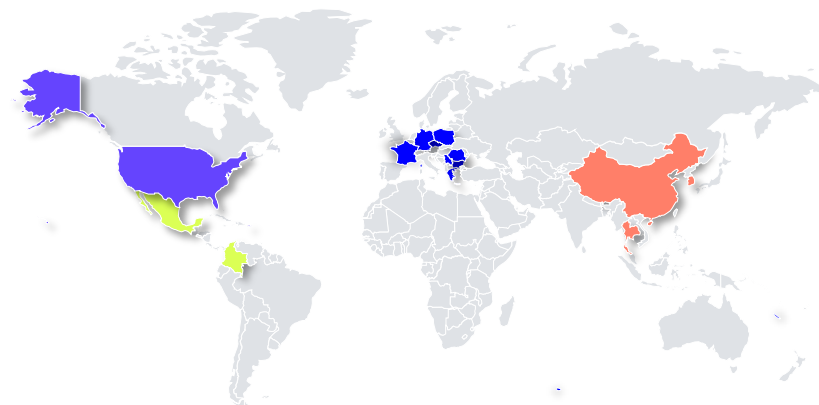
SOFTWARE

Android Automotive
Business Intelligence
Cloud Migration
Cyber Security
Data Analytics
Enterprise Solutions
Financial Systems
IT-Architecture
Certifications

TECHNOLOGY

Autonomous Driving
Battery Technology
Electric Powertrain
Energy Solutions
Industrialization
Charging Infrastructure
Operations Excellence
Task Force Management
Testing & Engineering

CONSULTING

Agile Transformation
Artificial Intelligence
M&A Strategy
Marketing & Design
Sustainability
Project Management
"Organizational Strategy"
Quality & Compliance
Systems Engineering
UX/UI Design
Transformation

P3 advises leading international OEMs, suppliers, technology and insurance companies in the field of autonomous driving and autonomous mobility.

P3
AUTONOMOUS MOBILITY
/AS UNUSUAL

>9 years of international experience in autonomous driving consulting

>100 customers worldwide and more than 300 successful AD projects

>50 employees around the globe in the autonomous driving space

75% of the employees are engineers and software developers

We approach autonomous driving from many different perspectives. We understand the markets, know the players, but also have the technological know-how and the necessary software expertise.

Market & Strategy

- Go-to-market strategy
- Global market and competitive analysis for AD MaaS, TaaS & ownership
- MaaS & TaaS business model development incl. business case & TCO
- Competence analysis, assessment of "best-fit" partners
- (SDS) partnerships models and joint venture agreements
- AD shuttle / robotaxi and ADAS in-field testing & benchmarking

Technology & Regulation

- End-to-end architecture assessment and customization
- Cybersecurity, Functional Safety & SOTIF
- Regulation Implementation (AD SMS, SUMS & CSMS for SAE L3 & L4)
- Test Strategies & Management & Tool Confidence
- Sensor set evaluation and platform fortification strategies
- Support for Homologation (Type approval ODD and operation area)

Operations & Scaling

- AD Program Management incl. strategic setup, operations strategy, organizational build-up, project conduct & benchmarking
- Scaled Pilots: setup and management of runup schemes for AD pilot projects
- AD Product Lifecycle Management AD Logistics Concepts - Conceptualization of market-ready TaaS products

STRATEGY & DUE DILIGENCE
BUSINESS CASE, TCO & COSTS
TECHNOLOGY SCOUTNG
SENSOR ROADMAPS
REGULATION & STANDARDS
COMPUTING HW ANALYSES
V2X & OPEN API
E/E ARCHITECTURE
DATA & SIMULATION
DRIVE BY WIRE
FUSA CYBER SECURITY
AD /SDS SW STACK
TESTING & APPROVAL STRATEGY
MAAS/TAAS PILOT FLEETS
PROJECT MANAGEMENT [AGIL]
PILOT/ FUNDING PROJECTS
HOMOLOGATION

P3 autonomous mobility.

Introduction ADAS practice

E2E consulting: From a holistic demand analysis to your individual tailor-made strategy - we are the right partner for your challenges in the field of ADAS.

360° **Demand Analysis**

In a first step, we jointly analyze and define your status quo, pain points and needs and sketch your future positioning and target picture in the ADAS ecosystem or specific market.

+

P3 **ADAS Portfolio**

You have the needs; we have the solutions. We draw on our unique ADAS Market, Competitor, Customer, and Tech Intelligence portfolio as well as innovative software-solutions.

=

Tailor-made **Project**

We jointly conduct your tailor-made technology or strategy project based on your capabilities and competencies and our long-term ADAS expertise.

P3 ADAS PORTFOLIO

We can help you with holistic AD(AS) market intelligence, tech scouting, strategic advice or operational support in technology, regulation and processes.

Customer & Market Intelligence

- Customer & market insights
- Revenue pool analysis and forecast
- Business model analysis & evaluation
- Global, scenario-based AD(AS) market models with distinction of SAE levels incl. global market ramp-up curves
- Analysis of supply chains, value chains and ecosystems
- Business case modelling

Go-to-Market Strategy

- Potential analysis for market entry & development of market entry strategies for ADAS
- Strategic target picture, business model & use case development (e.g., new services, products) for OEMs, Tech players, Tier 1/2s
- Elaboration of partnering / in-house strategies along the AD(AS) value chain

AD & ADAS Benchmarking

- ADAS testing, roadshows, workshops and customer clinics
- Quality of service benchmark for AD robotaxi services (EU, USA, CN)
- AD Readiness Index (MaaS and TaaS)

Technical Project Management & Regulation

- Ensuring product and technology readiness by installing task force leads and strengthen the organization in meeting milestones by an agile/hybrid task force approach
- Analysis of the relevant ADAS regulations in the lead markets US, Europe and CN
- Set-up of an overall regulation framework for product and process compliance

Commercial / Tech Due Diligence

- Tech-driven analysis of market- & value-pool size (TAM, SAM, SOM) and market positioning
- Competitive landscape & customer analysis
- Review of the company's products / services, structure, staff and business plan
- Analysis of sales and marketing structures

Technology Roadmaps

- Hardware & sensor roadmaps for L2-L5 ADAS vehicle databases
- Sensor technology analysis & V2X consulting
- Design and enablement for systems engineering in AD organizations
- Process implementation from need analysis, ConOps via requirements engineering & architecture to verification and validation

We are continuously conducting ADAS benchmarks worldwide.

P3 ADAS Benchmark China 2024

P3 ADAS Benchmark EU 2023

Recent events

Exemplary

P3 ADAS Benchmark Events

We test OEMs' ADAS capabilities using a **standardized methodology** combining **on-road testing** and **in-depth tech evaluations**. We engage with customers through **events and roadshows** featuring live demos, allowing us to efficiently analyze performance, UX, and the tech stack.

P3 Understanding of ADAS.

Technical differentiation for different automation levels

Overview of automation levels

CHALLENGES
- **Homologation & certification**
- **Quality of service**
- **Safety & reliability issues**

Main responsibility switches to system

Responsibility	*Driver* 1	*Driver* 2	*Driver* 2+	*OEM* 3	*OEM* 4	*OEM* 5
Automation Level	Driver Assistance **Hands on Eyes on**	Partial Automation **Hands temp. off Eyes on**	*Not an official SAE Level* Partial Automation **Hands temp. off Eyes on**	Cond. Automation **Hands off Eyes off**	High Automation **Hands off Mind off**	Full Automation **Driver off**
Definition of assistance level *Based on SAE & adapted by P3*	**Longitudinal or lateral guidance** • One-dimensional assistance • Full responsibility at driver	**Longitudinal and Lateral guidance** • Discontinuous two-dimensional assistance • Full responsibility at driver	**Longitudinal and Lateral guidance** • Hands Free driving in suitable conditions • Driver must always monitor surroundings and be ready to intervene	**Longitudinal and Lateral control by function** • System handle driving tasks under specific conditions • Driver must be ready to take control when needed. • Driver allowed to focus on side activities	**Full control by system in limited ODD** • System performing all driving tasks in specific ODD • Passenger aren't required to monitor the vehicle and don't need to take control	**Full control by system everywhere** • System performing all driving tasks under all roadway and environmental conditions • No Driver needed
Exemplary functions	**ACC**	**LKA and ACC**	**Tesla Autopilot**	**Highway Pilot/ Traffic Jam Pilot**	**City Pilot L4, Parking Pilot L4**	**Self-driving Mobility Services**

ACC = Automated cruise control, LKA = Lane keeping assist, ODD =Operational Design Domain

While the AD revolution is still waiting for major breakthroughs, short term focus shifts to ADAS & supporting technologies.

Proof of Competence achieved for Robotaxi (Level 4) but not yet profitable

Source: Waymo LLC

New ADAS functions (Level 2+ hands-free) will deliver real customer value

Source: BMW Group

AD / ADAS function will power development of new technologies (Steer by wire, new HMIs etc.)
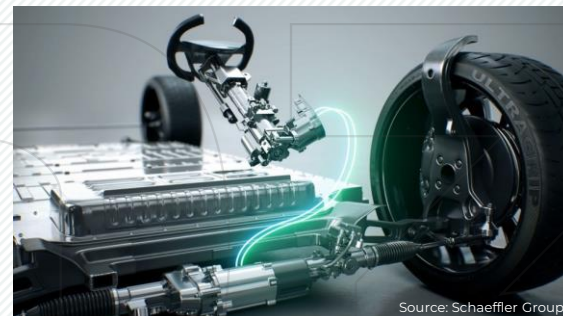
Source: Schaeffler Group

No scalability and profitability of AD L4 MaaS soon

ADAS L2+ / L3 will grow strong and gain higher penetration

Technology Ecosystem is emerging along the ADAS value chain

FOCUS

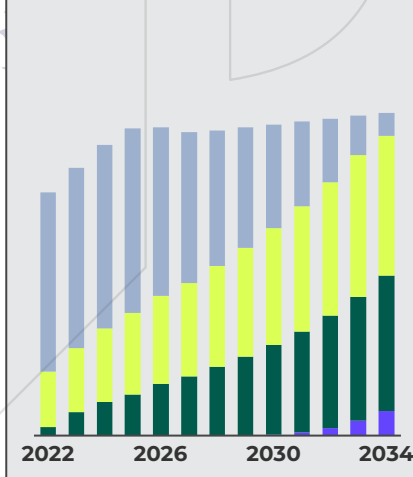**Exemplary P3 market model base case – numbers upon request**

P3

ADAS becomes standard, while large-scale L3 is not yet in sight. Yet, the fast-growing ADAS market provides opportunities to be taken.
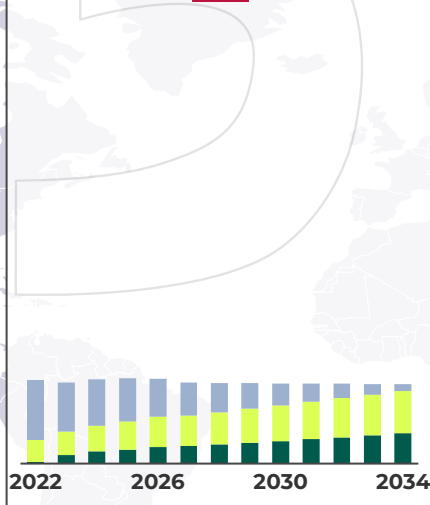
	Level 1	Level 2+
	Level 2	Level 3

🚗 *TOTAL SOLD PASSENGER VEHICLE NUMBERS PER SAE LEVEL* [units per annum, without considering SAE-Level 0, Level 4/5 share]***
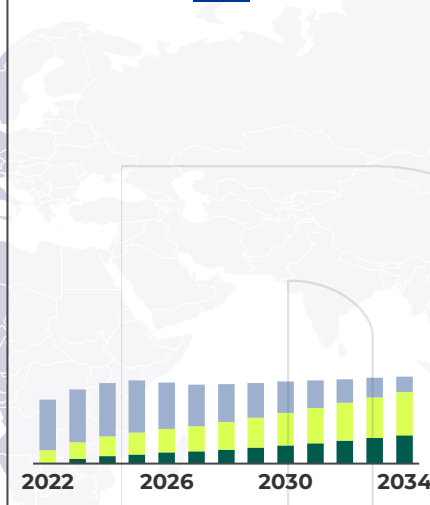

Global (US, EU, CN)
Cumulated

2022   2026   2030   2034

USA

2022   2026   2030   2034

Europe

2022   2026   2030   2034

China

2022   2026   2030   2034
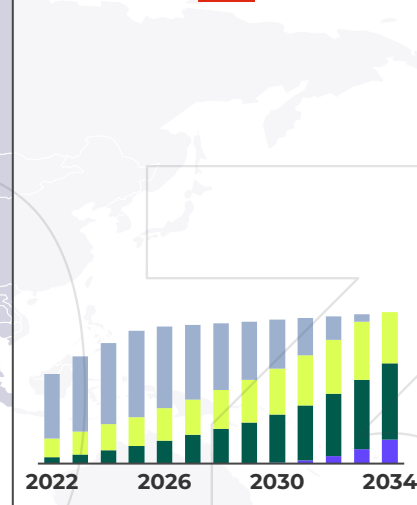
- • **Scenario-based modelling with the P3 market model** allows to explore different diffusion patterns based on chosen assumption set.

- • **Virtually every vehicle will be automized by 2030** – higher automation levels are on the rise, but L3+ yet lacks attractive price-performance ratio.

- • **Chinese market expected to have faster diffusion of higher SAE levels.** ADAS functionalities as differentiating factor in vehicle purchase.

* Number of sold passenger vehicles on request
** Unit sales based on statista data. Diffusion patterns of SAE level based on P3 market model

Increasing automation levels and new functions require a multitude of new hardware components and software.

Exemplary

Related HW setup
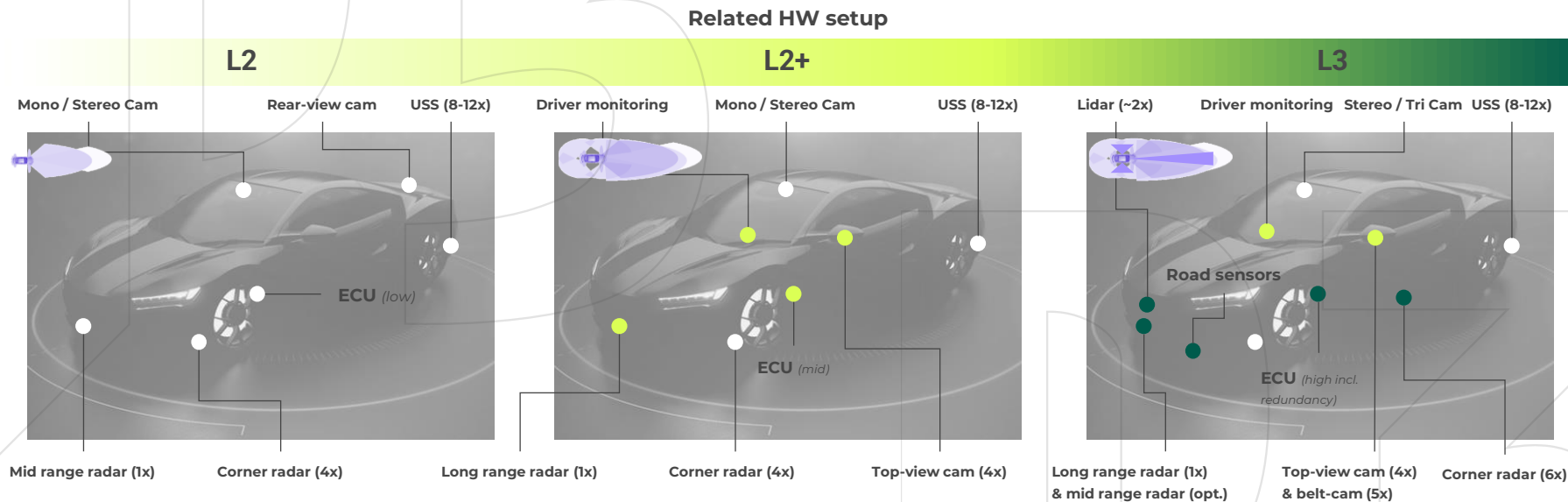
The challenge for OEMs lies in **balancing the increased costs** associated with the advanced hardware required for higher autonomy while ensuring **pricing stays attractive to end-users** and justifies the **added customer value.**

○ Components for L2   ● Additional components for L2+   ● Additional components for L3

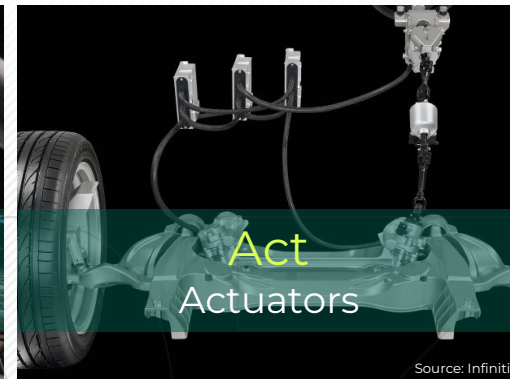# Developments and technology trends happen across whole sense-plan-act framework which P3 monitors closely

Sense
Sensors

Source: Zoox LLC

Plan
Processors

Source: BMW Group

Act
Actuators

Source: Infiniti

| Radars | Lidars | Cameras | ECU | SoC | Steer by wire | Brake by wire |

P3

Market development hypothesis

- **Camera**: **Strong growth expected** due to automation. Product will be highly commoditized
- **Radar**: **4D radars**, combined with cameras, will be the leading sensor modality for all <SAE L3 applications.
- **LiDAR**: The advancements in imaging radar performance, **need for LiDAR being reassessed** by industry players.

- Intelligence moves from sensor towards centralized high-performance **ECUs**.
- **Reliable functions required** for higher automation levels that is mostly achieved through **redundancy**.
- AI-driven development and training methods for SDS SW require high performance **SoC and ECU**.

- European OEMs will **not implement Brake-by-Wire/ (front-axle) Steer-by-Wire within the next 5 years**.
- Brake-by-Wire technology is **not pushed** by European TIER-1 nor OEMs.
- Steer-by-wire technology **reduces the mechanical complexity** in back wheel steering leading to more widespread adoption.

ADAS is increasingly seen as a differentiating factor that is gaining in importance and, depending on the approach, will also enable new business models.

Upgradeability & business strategy of OEMs

Exemplary
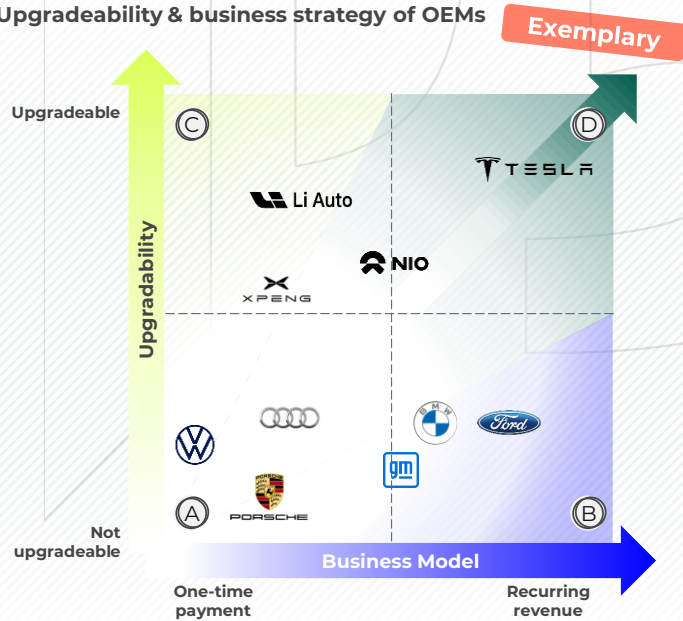
(A) Classic package approach
- Currently still predominant strategy for ADAS functions
- One-time purchase of ADAS functions with unlimited access for customer leads to direct one-time revenue
- Generally higher portfolio variation & complexity due to specific HW/SW sets for cost optimization

(B) Function subscriptions approach
- Initial purchase in combination with subscription based-model after defined use time or subscription only model leads to recurring revenue for OEMs
- Potential increased initial cost for OEMs to equip vehicles with necessary hardware for later function activation, but reduced portfolio complexity

(C) Upgradeable package approach
- Extensive hardware setup, enabling future upgrades in functionalities and automation levels Potential for future revenue by already sold vehicle by software w/o further hardware investment

(D) SW-driven upgrade & subscriptions approach
- Future-proof hardware setup enabling future upgrades through software in combination with on-demand subscription model enables recurring revenue and future one-time purchases with already sold vehicles without hardware adaption

The first players are already working on providing lasting **customer value and brand differentiation through ADAS**. This is both a challenge and an opportunity that requires a considered approach on the **business model and technology side** (upgradeability).

P3 Approach.

P3 Approach & Methodology

Focus on ADAS Driving Functions

P3

Steps of P3 Approach	Guiding Questions
1 Analysis and benchmark of the ADAS function portfolio from different OEM	Which ADAS function packages does the OEM offer? What ADAS functions do the function packages include?
2 Baselining ADAS function portfolios of OEM in the main markets EU, China and USA	Which of the ADAS functions are similarly offered by several OEM?
3 Clustering of the baselined ADAS functions	In which categories should the ADAS functions be clustered?
4 Allocation of the functions into the ODD/operational area for each player and market	Which ADAS functions does P3 consider to be offered and ready to use in which ODD (urban, highway) in main markets?

Outcome: Generic ADAS function list applicable for every OEM adapted to the function portfolio and availability in the main global markets.

P3 Definition of ADAS SAE-Level 2/2+ Function Packages (I/II)

Focus on ADAS Driving Functions

Area	Adaptive Cruise Control (ACC)	Lane Keeping Assist (LKA)	Lane Change Assist (LCA)
Highway	ACC maintains a constant speed and safe following distance.	LKA provides additional safety by keeping the vehicle centered in its lane, especially at higher speeds.	LCA ensures safe lane changes at high speeds by monitoring fast-approaching vehicles, warning the driver, and potentially intervening to prevent collisions.
Urban/ Rural	ACC handles frequent stop-and-go traffic by automatically braking and accelerating.	LKA is used for navigating tight, congested streets by preventing unintentional lane departure.	LCA helps drivers safely change lanes by monitoring blind spots and traffic, especially in heavy traffic.

P3 Definition of ADAS SAE-Level 2/2+ Function Packages (II/II)

Area	Traffic Sign Assist (TSA)	Traffic Light Assist (TLA)	Navigation on Pilot (NoP)
Highway	Recognizes and displays traffic signs, such as speed limits and regulatory signs, to improve safety and ensure compliance with traffic rules.	Traffic lights are less common on highways. However, in some countries, there are highway interchanges where traffic lights are installed.	Handles highway entry and exit ramps autonomously, ensuring smooth transition. Executes safe lane changes by monitoring traffic.
Urban/ Rural	Informs the driver about current speed limits, entry restrictions, and other regulatory signs.	Informs the driver about the status of traffic lights to help navigate busy intersections safely and efficiently.	Navigates complex intersections, identifies pedestrians and cyclists, manages tight spaces and heavy traffic.

P3 Definition of ADAS SAE-Level 3 Function Packages

Focus on ADAS Driving Functions

P3

	Traffic Jam Pilot	Highway Pilot	Urban Pilot
Definition	Autonomous driving system for congested traffic conditions at lower speeds, only on highway. It manages acceleration, braking, and steering without driver intervention.	Enables autonomous driving on highways at higher speeds, operating under certain conditions (e.g. clear road markings or moderate traffic).	Controls the vehicle in city environments, handling tasks like navigating intersections, detecting pedestrians, and obeying traffic signals.
Level 2 Functions included	• Lane Keeping Assist • Adaptive Cruise Control	• Lane Change Assist • Lane Keeping Assist • Adaptive Cruise Control • Traffic Sign Assist	• Lane Change Assist • Lane Keeping Assist • Adaptive Cruise Control • Traffic Sign Assist • Traffic Light Assist

ADAS One Pager Structure

Overview of the availability of L2/L2+ and L3 ADAS function packages in different ODD

Overview on relevant components and the related suppliers for ADAS

Sensor Setup of the most advanced ADAS vehicle

Specific information regarding ADAS functions

SAE-Level availability in the global market

Achieved SAE-Level

ADAS Overview

		Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic Sign Assist	Traffic Light Assist	Navigation on Pilot
L2/L2+ Function — Hands temp. off Eyes on	Function						
	Urban/Rural	✓	✓	✓	✓	✓	Not available
	Highway	✓	✓	✓	✓	✓	
L3 Function — Hands off Eyes off				Urban Pilot			
	Urban			Not available			
	Highway	Not available					✓

Supplier Overview*	Camera	Radar	LiDAR	ADAS SW	SoC/ECU	HD Map
	APTIV•	BOSCH	INNOVIZ	Arriver	mobileye	here
	BOSCH			STELLANTIS	Qualcomm	
	Valeo			TATA / TATA TECHNOLOGIES		
	mobileye			Valeo		

Sensor Setup

- 5x cameras
- 7x radars
- 1x lidar

Market Availability

- The L2 **BMW Driving Assistant Professional** is available in many BMW models, being often part of a larger package that includes several driver assistance systems.
- **BMW Personal Pilot L3** function can be ordered for the **new BMW 7 Series**.
- L3 only works on highways with barriers separating traffic, for **up to 60km/h**... function will be offered exclusively in **Germany** priced at 6,000 euros (incl. VAT).
- ...W Personal Pilot L3 is only available in conjunction with the relevant BMW Connected Drive services. ...iod of validity for these services is **two years.**

Urban — SAE-Level 2 — Highway — SAE-Level 3

ADAS.EU Players

ADAS Status, Evaluation & Latest News

ADAS EU | BMW

Consideration of most advanced ADAS vehicle

P3

Overview – ADAS Driving Functions

L2/L2+ Function
Hands temp. off
Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	*Not available*
Highway	✔	✔	✔	✔	✔	✔

L3 Function
Hands off
Eyes off

Function	Highway Pilot		Urban Pilot		Traffic Jam Pilot	
Urban/Rural			*Not available*		*Not available*	
Highway	*Not available*				✔	

Supplier Overview*

📷 Camera	⦿ Radar	☀ LiDAR	</> ADAS SW	▦ SoC/ECU	🗺 HD Map
APTIV	BOSCH	INNOVIZ	Arriver	mobileye	here

- Upon request -

Sensor Setup

- 📷 5x cameras
- ⦿ 7x radars
- ☀ 1x lidar

ADAS Snapshot

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- The BMW Personal Pilot L3 is only available in conjunction with the relevant BMW Connected Drive services. The period of validity for these services is **two years.**

Market Availability

🇪🇺 L2   🇺🇸 L2
🇨🇳 L2   🇩🇪 L3

* Based on Desk Research.
Not considering specific markets
Non exhaustive

Urban

SAE-Level 2

Highway

SAE-Level 3

ADAS EU | Mercedes Benz

Consideration of most advanced ADAS vehicle

Overview – ADAS Driving Functions

L2/L2+ Function — Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	*Not available*
Highway	✔	✔	✔	✔	✔	*Not available*

L3 Function — Hands off Eyes off

Function	Highway Pilot	Urban Pilot	Traffic Jam Pilot
Urban/Rural		*Not available*	*Not available*
Highway	✔ *		✔

Supplier Overview**

Camera	Radar	LiDAR	ADAS SW	SoC/ECU	HD Map
LG	BOSCH	Valeo	DVIDIA	BOSCH	

- Upon request -

Sensor Setup
- 6x cameras
- 5x radars
- 1x lidar

ADAS Snapshot

- The L3 System **"DRIVE PILOT"** will be available in the U.S. market (Nevada) as an option for model year 2024 **Mercedes-Benz S-Class** and **EQS Sedan** models.
- DRIVE PILOT can offer to take over the **dynamic driving task**, up to the speed of **95 km/h on German highways*.** Once conditions are suitable, the system indicates availability on the control buttons.
- The digital HD map provides a three-dimensional image of the road and the surroundings.
- L3 function will be offered exclusively in **Germany and the U.S** (Nevada and California) and is priced at **7,000 euros (incl. VAT).**

Market Availability

🇪🇺 L2 🇺🇸 L3
🇨🇳 L2 🇩🇪 L3

Urban — SAE-Level 2
Highway — SAE-Level 3

** Based on Desk Research.
Not considering specific markets
Non exhaustive

ADAS EU | Volkswagen

Overview – ADAS Driving Functions

L2/L2+ Function — Hands temp. off Eyes on	Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
	Urban/Rural	✔	✔	✔	✔	✔	*Not available*
	Highway	✔	✔	✔	✔	✔	*Not available*

L3 Function — Hands off Eyes off	Function	Highway Pilot		Urban Pilot		Traffic Jam Pilot	
	Urban/Rural	░░░░░░░░░		*Not available*		*Not available*	
	Highway	*Not available*		░░░░░░░░░		*Not available*	

Supplier Overview*	📷 Camera	◎ Radar	☀ LiDAR	</> ADAS SW	▣ SoC/ECU	🗺 HD Map
	Valeo	BOSCH	INNOVIZ	CARIAD	Continental	tomtom

- Upon request -

Sensor Setup

- 📷 2x cameras
- ◎ 3x radars
- ☀ No lidar

| Urban | SAE-Level 2 |
| Highway | SAE-Level 2 |

ADAS Snapshot

- The **VW "Travel Assist 2.5"** can be activated via the steering wheel and is available **in ID.4, ID.5, ID.7** and the **ID.BUZZ.**
- **Adaptive Cruise Control** is active from 30 km/h, **Lane Keeping Assist** from 65 km/h, and **Lane Change Assist** can perform lane changes at speeds from 90 km/h.
- The optional **hazard warning system** can warn you of roadworks or approaching emergency vehicles.
- **The drowsiness detection system** automatically alerts unfocused drivers via the instrument cluster and can autonomously stop the vehicle when needed.

Market Availability

🇪🇺 L2   🇺🇸 L2
🇨🇳 L2

* Based on Desk Research.
  Not considering specific markets
  Not exhaustive

ADAS EU

P3 Evaluation	Latest news

BMW seems to have greatly reduced its own activities regarding L3 and L4 and instead focuses on partnerships - most recently with Stellantis and Tata. In our regular ADAS benchmark drives, BMW's driver assistance systems show the strongest performance among all European OEMs.

BMW Group and Tata Technologies aim to collaborate for the development of Automotive Software and Business IT solutions.

(02.04.2024)

Drive Pilot is the world's first ADAS to gain **type approval for a L3 system** and available in Europe and the US. However, as the system's ODD is quite limited, there is currently only small added value for customers. For early 2025 Mercedes plans **L3 Highway Pilot** up to 95 km/h

Mercedes-Benz launches the next version of DRIVE PILOT for highly automated driving in Germany

(23.09.2024)

Volkswagen's ADAS strategy is built on a combination of **internal development through Cariad** and **strategic partnerships with industry leaders** like Bosch, Horizon Robotics, Qualcomm, and Mobileye, while also **focusing on localization** for specific regions like China.

Volkswagen ADMT announces agreement with Mobileye for autonomous driving

(20.03.2024)

ADAS.CN Players

ADAS Status, Evaluation & Latest News

Source: Xpeng

ADAS China | Xiaomi

Consideration of most advanced ADAS vehicle

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Overview – ADAS Driving Functions

L2/L2+ Function

Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	✔
Highway	✔	✔	✔	✔	✔	✔

L3 Function

Hands off Eyes off

Function	Highway Pilot		Urban Pilot		Traffic Jam Pilot	
Urban/Rural			*Not available*		*Not available*	
Highway	*Not available*				*Not available*	

Supplier Overview*

Camera	Radar	LiDAR	ADAS SW	SoC/ECU	HD Map

- Upon request -

Sensor Setup

- 11x cameras
- 3x radars
- 1x lidar

ADAS Snapshot

- **Xiaomi Pilot Pro**, an in-house developed ADAS system, is available on the **Xiaomi SU7** with easy NoP activation via a steering wheel button (but limited availability in complex city situations).
- The system faces challenges with lane control, and it lacks comfort features such as **FCA distance warnings**.
- It struggles with **ACC and LKA disengagements**, along with limited recognition of traffic signs, leading to frequent interventions for lane control.
- The **ADAS stack** is estimated to cost around **€4,050.**

Market Availability

L2+

Urban

SAE-Level 2+

Highway

SAE-Level 2+

* Based on Desk Research.
  Not considering specific markets
  Not exhaustive

ADAS China | XPENG

Consideration of most advanced ADAS vehicle

P3

Overview – ADAS Driving Functions

L2/L2+ Function
Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	✔
Highway	✔	✔	✔	✔	✔	✔

L3 Function
Hands off Eyes off

Function	Highway Pilot	Urban Pilot	Traffic Jam Pilot
Urban/Rural		*Not available*	*Not available*
Highway	*Not available*		*Not available*

Supplier Overview*

📷 Camera	◎ Radar	✷ LiDAR	⟨/⟩ ADAS SW	▦ SoC/ECU	🗺 HD Map
BOSCH	Continental	robosense	XPENG	DVIDIA	高德地图

- Upon request -

Sensor Setup

- 📷 11x cameras
- ◎ 3x radar
- ✷ 2x lidar

ADAS Snapshot

- Xpeng's "**XNGP"** (Xpeng Navigation Guided Pilot) ADAS system is available on the **P5, P7, G9, and G6** models, emphasizing Xpeng's proprietary AD software as a key market differentiator.
- **The AI Valet Driving** feature in XOS 5.1.0 can memorize and customize up to **10 driving routes** of up to **100 km** each during manual driving, functioning independently of XNGP's availability.
- The L2+ system includes Xpeng's **in-house developed mid-range Lidars** and a **user-friendly HMI** that supports lane change visualizations and **NoP functionalities in various driving scenarios**.

Market Availability

🇨🇳 L2+

Urban — SAE-Level 2+
Highway — SAE-Level 2+

XPENG

* Based on Desk Research.
Not considering specific markets
Not exhaustive

ADAS China | Li Auto

Consideration of most advanced ADAS vehicle

P3

Overview – ADAS Driving Functions

L2/L2+ Function

Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	✔
Highway	✔	✔	✔	✔	✔	✔

L3 Function

Hands off Eyes off

Function	Highway Pilot	Urban Pilot	Traffic Jam Pilot
Urban/Rural		*Not available*	*Not available*
Highway	*Not available*		*Not available*

Supplier Overview*
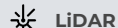
Camera	Radar	LiDAR	ADAS SW	SoC/ECU	HD Map
OFILM	BOSCH		Li Auto	NVIDIA	高德地图

- Upon request -

Sensor Setup

- 📷 11x cameras
- ◎ 1x radar
- ✳ 1x lidar

ADAS Snapshot

- **Li Auto's "AD Max" System** is available in the **L9 and Mega** models, offering strong ADAS performance, particularly in Navigation on Pilot (NoP), though its city-driving capabilities are currently limited.
- While the system delivers a generally **smooth driving experience** using **ADAS hardware from well-known suppliers**, it has issues with **ACC+LKA disengagements** and fails to recognize certain control signs.
- **The ADAS stack** in these models is estimated to cost around **€4,000.**

Market Availability

L2+

Li Auto

Urban

SAE-Level 2+

Highway

SAE-Level 2+

* Based on Desk Research.
Not considering specific markets
Non exhaustive

ADAS China 🇨🇳

P3 Evaluation

Xiaomi sets sight on several autonomous electric vehicle brands by **substantially investing in smart car technology**. The unveiled **Xiaomi SU7 offers great user experience at lower cost** than Western OEMs – the ADAS has still some weaknesses but is about to catch up with competition. Xiaomi successively releases **OTA updates** to increase performance

XPENG announced that its XNGP urban intelligent driving system now operates **100% HD map-free**, aiming for full coverage of major urban roads in China by the end of 2024. XNGP excels with a **robust ADAS and user-friendly HMI**, but has drawbacks like harsh acceleration, a low refresh rate for the digital rearview mirror, and difficulty recognizing scooter drivers.

Strong performance of ADAS NOP with **high availability** (but city cases limited). The AD Max System offers a **smooth driving experience** and **utilizes ADAS hardware components from well known suppliers**. However, drawbacks include a low refresh rate for the digital rear mirror, doors unlocking on the highway, a HUD projection appearing too distant

Latest news

Xiaomi SU7 to roll out urban NOA feature in ten cities.

(31.05.2024)

XPENG expands XNGP urban intelligent driving coverage to 336 cities in China.

(20.06.2024)

Li Auto sets up dedicated unit for end-to-end smart driving large model R&D.

(17.07.2024)

ADAS.NAR Players

ADAS Status, Evaluation & Latest News

ADAS NAR | Tesla

Consideration of most advanced ADAS vehicle

Overview – ADAS Driving Functions

L2/L2+ Function — Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	✔	✔	✔
Highway	✔	✔	✔	✔	✔	✔

L3 Function — Hands off Eyes off

Function	Highway Pilot		Urban Pilot		Traffic Jam Pilot	
Urban/Rural	*(striped/n.a.)*		*Not available*		*Not available*	
Highway	*Not available*		*(striped/n.a.)*		*Not available*	

Supplier Overview*

📷 Camera	◎ Radar	✴ LiDAR	‹/› ADAS SW	▣ SoC/ECU	🗺 HD Map
TESLA			TESLA	TESLA	Baidu 百度

- Upon request -

Sensor Setup

- 📷 8x cameras
- ◎ No radars
- ✴ No lidar

ADAS Snapshot

- Tesla's "**Autopilot**" comes standard on every new Tesla model for the U.S and Canadian market.
- With the computer for autonomous driving and the purchase of the "FSD" functionality, you can gain access to **additional FSD functions through future "over-the-air" software updates.**
- Tesla's autopilot system is **mainly based on cameras**. Tesla calls this strategy **"Vision Only".**
- The **Traffic-Aware Cruise Control** matches the speed of your vehicle to that of the surrounding traffic.
- The one-time purchase price has been cut to **$8,000** from a high of $15,000 in 2022. Tesla also offers a monthly subscription for FSD, which was reduced to **$99 per month in the U.S.**

Market Availability

🇪🇺 L2   🇺🇸 L2+
🇨🇳 L2   🇨🇦 L2+

* Based on Desk Research.
Not considering specific markets.
Not exhaustive.

TESLA

Urban — SAE-Level 2+

Highway — SAE-Level 2+

ADAS NAR | General Motors

Consideration of most advanced ADAS vehicle

P3

Overview – ADAS Driving Functions

L2/L2+ Function — Hands temp. off, Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	*Not available*	*Not available*	*Not available*
Highway	✔	✔	✔	*Not available*	*Not available*	✔

L3 Function — Hands off, Eyes off

Function	Highway Pilot	Urban Pilot	Traffic Jam Pilot
Urban/Rural		*Not available*	*Not available*
Highway	*Not available*		*Not available*

Supplier Overview*	📷 Camera	◎ Radar	✳ LiDAR	⟨⟩ ADAS SW	▦ SoC/ECU	🗺 HD Map
	Continental	Continental	*Cepton*	gm	mobileye	DYNAMIC

- Upon request -

Sensor Setup
- 📷 5x cameras
- ◎ 3x radars
- ✳ No lidar

ADAS Snapshot

- GM's **"Super Cruise"** L2+ system is **available on most Cadillac and Chevrolet models** on selected U.S. highways and can be activated by pressing a button on the steering wheel (when light bar turns green, it is available).
- When it is engaged, Super Cruise uses a **Driver Attention System** that monitors the system status and works to detect your head and eye positioning, reminding you to pay attention to the road.
- In newer versions of Super Cruise, the system can **automatically change lanes proactively** in certain situations, like when approaching slower traffic.
- On various Cadillacs, Super Cruise is a **$2,500 option or a $25 monthly subscription.**

Market Availability
- 🇪🇺 L2
- 🇺🇸 L2+
- 🇨🇦 L2

Left sidebar:
- Urban — SAE-Level 2
- Highway — SAE-Level 2+

GM

* Based on Desk Research.
Not considering specific markets
Non exhaustive

ADAS NAR | Ford

Consideration of most advanced ADAS vehicle

Overview – ADAS Driving Functions

L2/L2+ Function
Hands temp. off Eyes on

Function	Adaptive Cruise Control	Lane Keeping Assist	Lane Change Assist	Traffic sign Assist	Traffic Light Assist	Navigation on Pilot
Urban/Rural	✔	✔	✔	*Not available*	*Not available*	*Not available*
Highway	✔	✔	✔	✔	*Not available*	✔

L3 Function
Hands off Eyes off

Function	Highway Pilot	Urban Pilot	Traffic Jam Pilot
Urban/Rural		*Not available*	*Not available*
Highway	*Not available*		*Not available*

Supplier Overview*

Camera	Radar	LiDAR	ADAS SW	SoC/ECU	HD Map
MAGNA	Continental		mobileye	Qualcomm	mobileye

- Upon request -

Sensor Setup
- ~ 5x cameras
- ~ 3x radars
- No lidar

ADAS Snapshot

- Ford's **"BlueCruise"** is available to customers of **Mustang Mach-E, F-150 and Expedition** vehicles purchased in countries with designed Highways (**Blue Zones**).
- It can be used in a total of **15 European countries**, following approval by the European Commission.
- Drivers using BlueCruise in Blue Zones can drive with their **hands off the steering** wheel so long as they continue to pay attention to the road ahead.
- A **driver-facing camera** located below the instrument cluster checks the driver's eye gaze and head position.
- Ford's BlueCruise costs **$2,100 for 3 years** upfront, **or $800/year** or **$75/month** after a trial.

Market Availability
- EU: L2+
- US: L2+
- Canada: L2

* Based on Desk Research.
Not considering specific markets
Non exhaustive

Urban — SAE-Level 2
Highway — SAE-Level 2+

ADAS NAR

P3 Evaluation

Tesla **collects a huge amount of data** and build a unique ecosystem around the fleet. While there are still legitimate discussions about the robustness of vision-only approaches, the **performance of FSD in the US is already impressive**. Nevertheless, it is still an L2+ system.
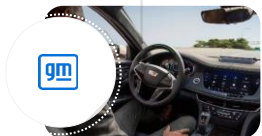
GM has **combined its former Ultra Cruise system** (former goal to achieve hands-free driving for 95 percent of scenarios) **with its Super Cruise program.** May there also be a chance for struggling GM-backed Cruise to power GM vehicles? Also, in **China, GM has invested in Momenta**.
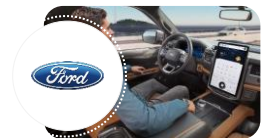
After getting off the robotaxi business with Argo.AI, Ford said **to focus on developing differentiated L2+ and L3 applications** for privately used cars. By 2023, Ford established Latitude to develop future automated driving technology.

Latest news

Elon Musk confirms Tesla 'robotaxi' event delayed due to design change.

(15.07.2024)

GM's hands-free Super Cruise expands to 750,000 miles.

(14.02.2024)

Ford BlueCruise hands-free driving technology approved for customers to use across the highways of Europe.

(31.07.2024)

Key Takeaways.

Summary and assessment

Performance and functionality of Chinese systems is ahead of competition, especially for Level 2+ systems which have highest market shares in the next years

		USA OEMs	European OEMs	China OEMs
Level 2	Lane keeping & Active Cruise Control	● Industry standard	● Industry standard	● Industry standard
Level 2+	Navigation on Pilot **on Highway**	◑ Available by Tesla FSD Beta and GM, Ford	◔ Available by BMW but limited in performance / ODD	◕ Available for most CN highways
	Navigation on Pilot **in City Routes**	◔ Available by Tesla FSD Beta 12.5.	○ N/A	◕ Available even in most dense traffic situation in major cities
Level 3	**Traffic Jam Pilot** (max 60 km/h) (no driver supervision)	◔ Limited availability	◔ Limited availability by BMW / MB	○ Legislation pending– planned for 2025
	Highway Pilot (max 130 km/h) (no driver supervision)	○ Not available yet	○ Not available yet – planned for 2025	○ Legislation pending – planned for 2025

❯❯ As major tipping points have been reached and **wide-spread adoption** is expected, the fierce competition in the ADAS market is intensified by **fast-learning Chinese players**. OEMs and suppliers need to set a **clear strategic path** to prevail in the market.

Low Maturity ◔ ◀▶ ● High Maturity

We can help international ADAS players to draw strategic implications and critical actions for to succeed in the fast-growing ADAS Market.

Exemplary implications and actions to be taken

Architectural sovereignty + strong partnership	Software Defined Vehicle Approach for ADAS	"Tier 0.5"-model vs "Tier 1"	Virtualize Testing and Validation	Implement ADAS Beta Testing Program
Full ownership for product (SW) stack require but max. leverage of partners and market existing assets	Drive abstraction not only for HW but also between operating system and application layers for parallelization	Integrate Tier's (e. g. Huawei's) system architecture incl. major components, leveraging existing building blocks, avoid custom builds (at least as parallel option)	Enhanced digital validation (Cloud-based testing, HIL in the Cloud) and vertical integration, reducing interfaces for faster troubleshooting and assurance.	Similar to Tesla's in the USA, avoiding the need for fully complete versions, increase user adoption and rapid roll out / updates

P3 Services

# Partner Screenings # Cooperation Mgmt # Integration Support	# Architecture reviews # SDV readiness benchmarks # SDV best practice transfer	# Core / non-core assessments # Supplier reviews and strategy # Supplier management	# Virtualization / Digital twin approach # SofD Car expertise Transfer # Tool reviews	# product & go-2-market strategies # innovations & forward thinking "trust in autonomy etc."

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