Software-defined vehicles – revolutionizing the automotive industry

November 2024

Software-defined vehicles (SDVs) catalyze Automotive transformation

Executive summary

1 — SDVs are characterized by **decoupling hardware and software, building architecture-led platforms**, and **centralizing E/E[1] architectures.** While **no OEM** has launched a "**full" SDV**, **Chinese** and **US players are leading in SDV maturity**.

2 — The advent of SDVs **re-shuffles automotive value pools. The markets for software development (+ €36bn), E/E development (+ €13bn), and E/E components supply**[2] **(+ €199bn)** are expected to **grow at ~5% CAGR** until 2035, above the industry average.

3 — While we expect **European OEMs to extend their capabilities** and continue to **drive the European ecosystem**, **tech players dominate the Chinese market**, **disrupting the traditional value chain** and **re-shaping value propositions**.

4 — **European OEMs' profits may increase by €20bn by 2035,** due to the increasing market size and the shift to more profitable value pools in an OEM-partnering scenario; **if the transformation fails, €20bn in profits are at risk.**

5 — The **transformation requires OEMs and suppliers** to **adapt** their **way-to-play** and **operating model**. To **fully participate in the growth opportunities**, large gaps observed in **organization**, **processes, governance, people and culture,** and **tools** need closing.

6 — **Effective partnering**, especially with tech players, will be essential for OEMs and suppliers to realize their strategies, **balancing standardization** to gain economies of scale **with proprietary innovation** to differentiate across competition.

What actually are SDVs?

A 'software-defined vehicle (SDV)' is an automobile that relies on **digital technology**. **All functionalities**, incl. driving, entertainment, communication, safety, and comfort, are **enabled**, **managed**, **controlled**, and **customized through software**.
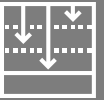
SDVs are connected to the **cloud** and **interact digitally** with their **environment**. New functionalities are **continuously deployed** over the air **without requiring hardware changes**.

Key SDV development characteristics are the **separation of software from hardware**, which enables scalability and development time reduction, and **integration into digital ecosystems**.

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Beyond unlocking a world of benefits for customers, developing SDVs is paramount for OEMs to stay competitive

Benefits of SDVs

Reduced costs
- One-time development and validation costs
- Reduction of recall costs through OTA[1] updates
- Less need for specialized hardware

OEM: ★★★★★
Customer: ★★☆☆☆

Upgradability and flexibility
- Product changes OTA without hardware change
- Remote maintenance and remote healing
- Configuration to user and regulatory needs

OEM: ★★★★☆
Customer: ★★★★★

Shorter time-to-market
- Parallel and iterative development cycles
- Rapid prototyping/testing in the virtual environment
- Easier integration of software and hardware

OEM: ★★★★★
Customer: ★★☆☆☆

Modern user experience
- Customization to brand and user preferences
- Smartphone-like interfaces
- Up-to-date user experience

OEM: ★☆☆☆☆
Customer: ★★★★★

Differentiated business model
- Subscription- or usage based services
- Continuous revenue from OTA updates
- Differentiated pricing of features possible

OEM: ★★★★☆
Customer: ★★★☆☆

Ecosystems integration
- Effortless integration into multiple ecosystems
- Usage of 3rd-party applications
- Easier collaboration with equipment suppliers

OEM: ★★★★☆
Customer: ★★★★☆

Increased performance
- Usage of data to improve performance
- Intelligent control based on sensor data
- AI-supported services

OEM: ★★★☆☆
Customer: ★★★★★

Improved safety and security
- Advanced safety functions
- V2X[2] data exchange and swarm intelligence
- Remote vehicle control and theft prevention

OEM: ★★☆☆☆
Customer: ★★★★★

🚗 OEM benefit   👤 Customer benefit

The shift in technology and architecture will disrupt the automotive value chain, redefining its players' way-to-play and operating model

Areas of SDV disruption

Product technology and architecture

Description

- **Emergence** of **software-based** functionalities with **centralized computing** (e.g., ADAS)
- **Extension** of **product lifecycle** and **connectivity** through OTA updates and cloud services (e.g., new infotainment software)

Challenges

- Software development
- Handling of legacy technology
- System integration
- Industry-wide standards on interfaces
- Semiconductor capabilities
- Cybersecurity concept

Value chain and new industry players

- **Entrance** of **players from outside** the **auto industry** with expanded **service offerings** and **direct competition** to OEMs
- **Combatting product complexity** through **co-innovation** on **platforms**, **collaboration,** and **revenue sharing**

- Deals strategy
- Partnerships, cooperation, open innovation strategy
- Anti-trust strategy
- Public incentives/funding strategy
- Transfer pricing/taxes/customs strategy

Way to play

- **Adapting value proposition** and **business model** to counteract cutthroat competition
- **Re-defining** the **way-to-play** within the **new value chain** (e.g., inhouse, partnering) to **increase speed**

- Value proposition
- Offering characteristic
- Approach to market
- Competitive focus
- Monetization strategy

Operating model

- **Shift** in **organization, governance, processes, talent,** and **culture**
- **Continuous** and **scaled development** and **homologation** with **integrated toolchains**

- IT and systems strategy, e.g., toolchain/PLM[1], digital twin
- IP[2] management
- HR/workforce transformation

SDVs require a layered software and hardware architecture, which enables software development and operations independent of hardware

SDV architecture stack (simplified view)

Mobility ecosystem

In-vehicle layers

Domains
- Connectivity update mgt.
- ADAS/AD[3]
- Motion and energy
- Infotainment and body

Software layer:
- Application and UX[1]
- Extended services and data
- Basic services and OS[2]

Hardware and E/E layer:
- Compute
- Zone and communication
- Sensor/actuator

Cloud layers

Domains
- Services
- Backend

- Application and UX
- Automotive and general extended services and data
- Basic services and cloud OS
- Data center
- Communication infrastructure
- Environmental sensing

Support
- Digital lifecycle management (incl. continuous integration)
- Development and test environment / end-to-end toolchain
- Safety and security management

SDV architecture highlights

- Includes **in-vehicle** and **cloud components**
- **Separation** of **hardware** and **software** for **rapid updates** and **hardware-independent software operations**
- Separation is achieved through a **layered architecture** akin to those used by hyperscalers
- Enables **modular development** of **software**, together with **other players**
- **Applications** and **functionalities** are created by **combining** underlying **services across layers**
- **Services** are used across and within layers via **standardized APIs[4]**

●—● Access via standardized interfaces   1) UX = User experience   2) OS = Operating system   3) ADAS/AD = Advanced driver-assistance system
4) API = Application programming interface

For their E/E architecture, OEMs decide on domain vs. zonal paths mainly based on their heritage and partner landscape

Hardware and E/E centralized architecture potential paths

Hardware and E/E layer

- 4 Compute layer
- 5 Zone and communication layer
- 6 Sensor/actuator layer

Distributed E/E architecture	Current domain (zone) or cross-domain (zone) centralized E/E architecture	Future vehicle-concentrated and vehicle cloud computing E/E architecture

Distributed ECU with first consolidation

Central gateway

Domain[1] path

Zonal[2] path

Domain centralization — Cross-domain fusion — Vehicle computer

Zone centralization — Part-zone fusion (master-slave) — Vehicle computer and zone controller

Vehicle computer — Cloud computing platform

Central computer — Cloud computing platform

Time

One path	Parallel paths	One path

Comment

- Centralization has a **functional (logical)** and **physical (wiring)** aspect
- **OEMs will apply a hybrid approach** between domain and zonal paths
- Which functionality will be moved to zone controllers and/or central compute units **depends on the OEM's software skills and its supplier's strategy**
- **Traditional OEMs** typically follow the **domain path**, whereas **newer OEMs** (e.g., Tesla) follow the **zonal path**

ECUs[3] without integration ☐   ECUs integrated ▓   DCU[4] ■   DCU functionally stripped ☐   Fusion of all DCUs in a VC ⬚   ZCU[5] ■

ZCU functionally stripped ▨   Vehicle computer (VC) ▧   Vehicle and cloud computing units ▨   Fusion of all ZCUs in a VC ⬚

The level of centralization depends on domain-specific requirements – ADAS/AD and infotainment might be integrated as one central compute

Level of functionality integration

Criteria for integration

Level of integration determined by 7 criteria:

- Compute requirement
- Security requirement
- Specialized/niche capabilities
- Impact on cost and weight
- Safety and real-time requirement
- Fast start-up requirement
- Frequent update not required

Domain

Potential level of integration (logical and physical)

| Distributed ECU | Zone compute | Central compute | Cloud |

Complexity (vertical axis, increasing upward)

Domain	Content
ADAS/AD	... L2+ driver assistance / L3+ automated driving / Enabler (e.g., sensor fusion)
Infotainment	... ... UX/UI / Display and audio / 3rd-party applications
Powertrain	Specialized component control (e.g., power electronics) / Engine control / Gearbox / ...
Chassis	ABS/ESP / Steering/suspension
Body/Comfort	Climate / Seating

- ADAS/AD and infotainment might be integrated into one central compute unit
- Eventually, integration on SoC[1] level (fusion chip)

- Powertrain and chassis might be integrated into one domain controller
- Specialized ECUs in powertrain and chassis will not be integrated
- Body functions likely to be integrated fully in zone controllers

Xx = Exemplary function   Likely allocation of function

Chinese vehicle models are the most advanced with regard to SDV characteristics, and have surpassed US and EU players

SDV maturity of recent launches

SDV maturity (evaluation across selected dimensions)

SDV maturity levels[1]

	E/E-controlled	Partially software-defined	Fully software-defined
Software/ E/E architecture	SW[2] and HW[3] distributed	SW modular, HW domain-oriented	SW service-oriented, HW centralized
Software updatability	Manual	Non-safety-critical OTA updates	Safety-critical OTA updates
Safety and security[4]	Basic	Advanced	Autonomous driving (L4)
User experience	Static	Connected	Personalized
Ecosystem integration	Basic access	V2X communication	Seamless integration

Legend:
- ● Chinese electronics player sportscar
- ◆ Sedan based on Chinese tech player SDV stack
- ● German EV premium vehicle
- ▲ German EV volume sedan
- ● US EV bestseller

Perspective on SDV market

- We have defined **SDV maturity levels** to evaluate the status of the industry transition

- Our evaluation shows that **Chinese players** are **currently leading the market** in terms of software, E/E architecture, and updatability

- User **experience and ecosystem integration** is also **led by Chinese** players, **followed by US players**

- In the areas of **automated driving**, safety, and security, **European players are leading**

1) Detailed definition along all five maturity levels: https://www.pwc.com/jp/en/knowledge/column/definition-of-sdv.html
2) SW = Software   3) HW = Hardware   4) Safety refers mainly to active safety and automation (i.e., automated driving), security refers to cybersecurity. The dimensions were evaluated separately but summarized to simplify the visualization.

E/E supply, incl. software and E/E development, is expected to grow at ~5% p.a., leading to opportunities for new market entrants

Market expansion opportunities

1 Software development [EUR bn]

Legend:
- ADAS
- Infotainment and Connectivity
- Enabler
- Powertrain
- Chassis Control
- Body and Comfort

+4.9% p.a.

	2025	2030	2035
Total	59	78	95
Body and Comfort	3	5	5
Chassis Control		5	6
Powertrain	4	4	6
Enabler	8	10	12
Infotainment and Connectivity	12	15	19
ADAS	28	39	49

- **ADAS** and **infotainment domains** have the **largest total addressable market**
- **Infotainment and connectivity** and **enabler functions** are driven by cybersecurity needs
- **Significant growth contribution** expected from traditionally less software-driven areas **like body and comfort** and **chassis control**

2 E/E development [EUR bn]

Legend:
- Software Development
- Hardware E/E Development

+5.2% p.a.

	2025	2030	2035
Total	76	102	126
Hardware E/E Development	18	24	31
Software Development	59	78	95

- **Software suppliers** enter the **E/E market** to **improve** their **offerings' performance; tech players** benefit from modularized **architectures**
- **Levers: design software and hardware** from a **single source**[1] and **customize to application**[2]
- Further opportunities through **standardization with automotive chiplets**

3 E/E supply [EUR bn]

Legend:
- SW & HW E/E Development
- ADAS
- Infotainment and Connectivity
- Powertrain excl. Battery
- Chassis Control
- Body and Comfort

+5.3% p.a.

	2025	2030	2035
Total	368	483	617
Body and Comfort	45	55	65
Chassis Control	34	43	52
Infotainment and Connectivity	78	123	108
Powertrain excl. Battery	99	81	153
ADAS	36	80	112
SW & HW E/E Development	76	102	126

- Movements of selected **tech players into fast-growing E/E supply segments** to manifest control over electronics and leverage existing capabilities
- ADAS and Powertrain growth is **significantly driven by the increase in ADAS and BEV**[3] **take-rate**

We differentiate four future SDV market scenarios – incl. a tech-dominated scenario in which tech players become the new OEMs

SDV value chain dynamics and scenarios (simplified[1])

Based on Strategy& SDV market model

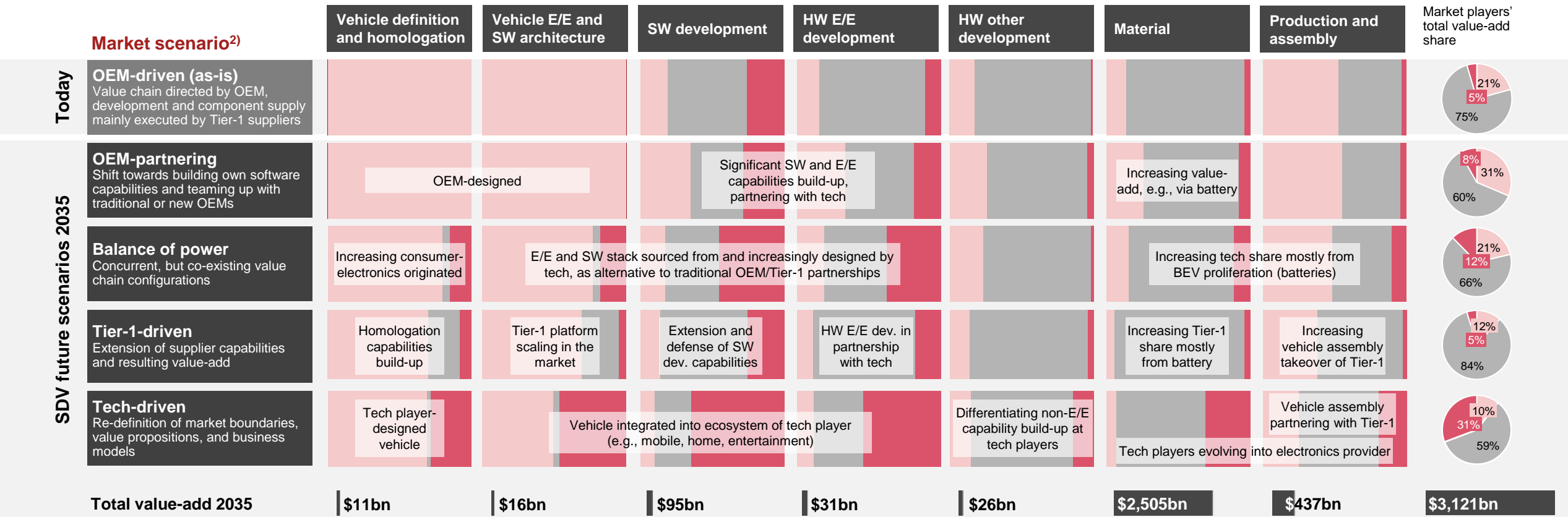| Market scenario[2]	Vehicle definition and homologation	Vehicle E/E and SW architecture	SW development	HW E/E development	HW other development	Material	Production and assembly	Market players' total value-add share
Today — **OEM-driven (as-is)** Value chain directed by OEM, development and component supply mainly executed by Tier-1 suppliers								21% / 5% / 75%
OEM-partnering Shift towards building own software capabilities and teaming up with traditional or new OEMs	OEM-designed		Significant SW and E/E capabilities build-up, partnering with tech			Increasing value-add, e.g., via battery		8% / 31% / 60%
Balance of power Concurrent, but co-existing value chain configurations	Increasing consumer-electronics originated	E/E and SW stack sourced from and increasingly designed by tech, as alternative to traditional OEM/Tier-1 partnerships				Increasing tech share mostly from BEV proliferation (batteries)		21% / 12% / 66%
Tier-1-driven Extension of supplier capabilities and resulting value-add	Homologation capabilities build-up	Tier-1 platform scaling in the market	Extension and defense of SW dev. capabilities	HW E/E dev. in partnership with tech		Increasing Tier-1 share mostly from battery	Increasing vehicle assembly takeover of Tier-1	12% / 5% / 84%
Tech-driven Re-definition of market boundaries, value propositions, and business models	Tech player-designed vehicle	Vehicle integrated into ecosystem of tech player (e.g., mobile, home, entertainment)			Differentiating non-E/E capability build-up at tech players	Tech players evolving into electronics provider	Vehicle assembly partnering with Tier-1	10% / 31% / 59%
Total value-add 2035	$11bn	$16bn	$95bn	$31bn	$26bn	$2,505bn	$437bn	$3,121bn

SDV future scenarios 2035

Legend:
- Automotive OEM
- Traditional Tier 1/2
- Technology player incl. SW engineering service provider

1) Schematic and simplified visualization excl. time dynamics of absolute market volumes or shares
2) Market scenarios describe a theoretical pure play state in which Automotive OEMs, Tier 1/2 suppliers, and tech players interact with each other
Source: Strategy& SDV market model

European OEMs' profit may increase by €20bn by 2035 due to SDV-enabled increase in value-add; if transformation fails, €20bn is at risk

Focus European OEMs: Value-add and profit development

Market scenario[1]	Value-add in 2035 [€ bn]	Revenue in 2035 [€ bn][2]	Profit in 2035 [€ bn][3]
OEM-partnering — Shift towards building own software capabilities and teaming up with traditional or new OEMs	~330 **(+160)**	~1,070 **(+240)**	~60-80 **(+20)**
Balance of power — Concurring, but co-existing value chain configurations	~220 **(+50)**	~830 **(+0)**	~40-60 **(+0)**
Tier-1-driven — Extension of supplier capabilities and resulting value-add	~120 **(-50)**	~780 **(-50)**	~30-50 **(-10)**
Tech-driven — Re-definition of market boundaries, value propositions and business models	~100 **(-70)**	~660 **(-170)**	~20-40 **(-20)**

SDV future 2035

As-is 2025 EUR ~170 Bn — **As-is 2025 EUR ~830 Bn** — **As-is 2025 EUR ~40-60 Bn**

Implications for EU OEMs

- **Value-add** of European OEMs may vary between **€330bn and €100bn** depending on the market scenario

- The shift **from a hardware-centric to a software-defined** product also shifts **profit pools**, as the highly profitable area of software has above-market growth, and new players are entering the market

- Depending on the OEMs' **strategic direction**, **way-to-play**, and **ability to execute**, the change in profits is expected to range between an **increase of €20bn** and a **decrease of about €20bn** in 2035

The likely SDV scenario differs across regions based on ecosystem, technology, customer, and regulatory characteristics

Regional scenarios and characteristics

	🇪🇺 Europe	🇺🇸 United States	🇨🇳 China
Ecosystem players	• **OEMs leading the value chain**, but reliant on **partnerships** for **innovation execution** • **Tier-1 progress in software**, but OEM-dependent • **Few** relevant **local tech players**	• Incumbent **OEM vehicles mainly conservative**, **new entrants** with **innovation leadership** • **Tier-1s hardware-focused**, software evolving • **Tech players** strong in **ADAS/AD**, **E/E**, and **cloud**	• **Incumbent OEMs** moving **towards SDV** • **Tier-1s** with strong **tech capabilities** at scale • **Tech players** strong in **ADAS/AD**, **electronics**, and cloud; already established as OEM/Tier-1
Auto technology	• Focus on **BEV catch-up,** but volatile demand • **ADAS advancements**; selected **AD extensions** • **Slow time-to-market** due to complex legacy platforms and organization; cybersecurity and data privacy imperative	• **Incumbents** focus on **ICE[1]**; extended time-to-market • **New entrants** focus on **BEV-/SW-driven architectures**; short time-to-market • Tech players and OEMs drive **AD fleet progress**	• Focus on **BEV** and **connectivity** across players, **software-driven architectures** quickly proliferating • **Tech players** drive **AD fleet progress** • **Strong customer-centricity** and **short time-to-market** as imperative, yet less focus on quality
Customers	• **Conservative customers** valuing quality, safety, and data protection over experimental innovation	• **Convenience-seeking** customer base • Strong **digital consumer ecosystem**	• Very large **tech-savvy customer base**, native in **tech-driven ecosystems**
Regulation	• **Fragmented regulatory landscape** with high priority on **decarbonization** as well as **protecting the individual** (e.g., data privacy, traffic safety)	• **Fragmented regulatory landscape** with **localized innovation hubs** (e.g., California, Texas) and policies to **foster local business**	• **Coordinated regulatory landscape** with high **priority on protecting the collective** (e.g., data provision obligation) • **Strong state R&D support** to advance society
Likely SDV scenario	**OEM-partnering**	**Balance of power**	**Tech-driven**

OEMs need to decide on their future way-to-play, which defines their value chain coverage

OEMs' ways-to-play in the SDV era

Combinations possible

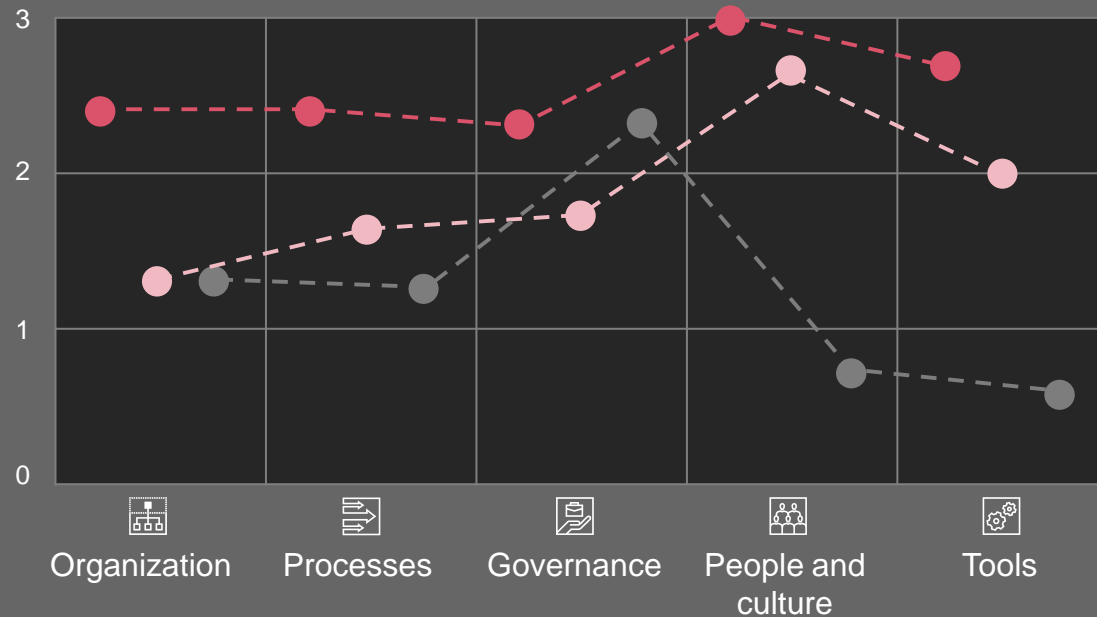|	SDV category leader	SDV premium player	SDV value player	SDV platform provider	Made-to-order producer
Value proposition	Offers **innovative SDVs** and **shapes** the **market** with its **own platform** and **ecosystem**	Offers **premium SDVs** tailored to **customers**, in partnership with SDV **platform provider**	Offers **low-priced SDVs** integrating **off-the-shelf** solutions, leveraging **economies of scale**	Offers an **integrated, turn-key** and **open tech ecosystem** and **tech stack** for OEMs	Offers **scalable made-to-order production** and **vehicle assembly services** globally
Differentiation	Strong **brand** using the **latest technology** within an **integrated ecosystem**	Close **customer relations**, **claiming** to **solve customer needs**	Product **ubiquity** and **simplicity**; sales via **own** and **3rd-party channels**	Facilitation of **3rd-party innovation**; strong **B2B solution sales** and **support**	**Scalable** and **flexible production**; close **OEM relation** with **key account sales**
Competitive focus	Competes **on technical superiority** and **integrated/ seamless solutions**	Competes on **choice**, **fit-for-purpose**, and **completeness** for its **customer profiles**	Competes **on price-for-value** with a focus on **scale, product robustness,** and **simplicity**	Competes on **completeness**, **simplicity**, and **continuously growing platform scale**	Competes on **production technology**, **scale**, **global** delivery capabilities, and **price**
SDV value chain	**Broad coverage across all steps** with **high in-house investments**	**Selective coverage** for **differentiating elements, partnering** for E/E development	**Limited coverage, cost-focus on essential elements, buys** E/E development	**Focus on B2B[1] SW and E/E solutions, minimal coverage in vehicle definition**	**Narrow coverage** in **vehicle definition,** focus **on scalable development and production**

OEMs' transformation need depends on the chosen way-to-play and their existing capability set – largest gaps are to SDV category leader

OEMs' implications on operating model

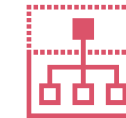**Illustrative transformation need of a legacy premium OEM**

Capability gap based on the legacy premium OEM's existing capability set

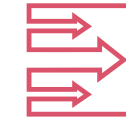**Selected ways-to-play**

SDV category leader

SDV premium player

SDV value player

Differences in transformation need

Capability gap from **strong customer-centric product development** and **dedicated architecture department;** generally increasing need for **partnership management**

Transformation to **software- and SDV architecture-led development** with lean, automated processes; generally increasing need for **tech integration capabilities**

Governance efficiency mandatory for all ways-to-play; differences in **flexibility of partnership models**; value player with **rigid approach focusing on costs**

Hiring/retention of **top tech talents** and **fostering a culture of innovation** decisive for category leader and premium player

Shift towards continuous improvement of automated end-to-end development/testing **toolchain;** however, **value player** with **low DevOps** and **simulation needs**

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Legend: 0 = best-in-class, no transformation need, 1 = strong capabilities, low transformation need, 2 = some capabilities, medium transformation need, 3 = little capabilities, high transformation need; Source: Strategy& SDV capability profiler

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Automotive OEMs are already shifting today towards architecture-led development with implications on partnering with suppliers

Architecture-led SDV platform development

SDV platform

Strategic direction, targets, feature requests, regulatory requirements, etc.

SDV vehicle architecture

System architecture concept, targets, requirements, roadmap

SDV software release train

SDV hardware component kit

Q1   Q2   Q3   Q4

Major software release
- One time per year
- Significant functionality uplift

Minor/maintenance release
- At least three times per year
- Bugfixes and optimizations

Hardware component kit
- Updated twice per year
- Approved hardware components and variants

Vehicle projects

Vehicle project 1
Vehicle project 2
Vehicle project 3
Vehicle project 4

Recombine **hardware components** matching to SDV vehicle architecture constraints and specific vehicle target audience

Use last **software release**, configure for selected hardware and target vehicle, extend software if needed to specific vehicle needs

Platform characteristics

- **One** vehicle architecture for all models, model series, and brands
- **One software** team ("software release train") developing and regularly releasing updates
- **One hardware** team defining hardware components and combinations (similar to model series concept)
- **Vehicle projects** individually use and recombine hardware components and configure software to their brand, vehicle type, and target audience
- Suppliers need to adapt their way-to-play based on the OEMs' platform development

OEMs need to adapt their partnering strategy, based on their way-to-play configuration and their E/E architecture strategy

Partnering strategy considerations

Illustrative – specific needs to be defined by each OEMs' ambition
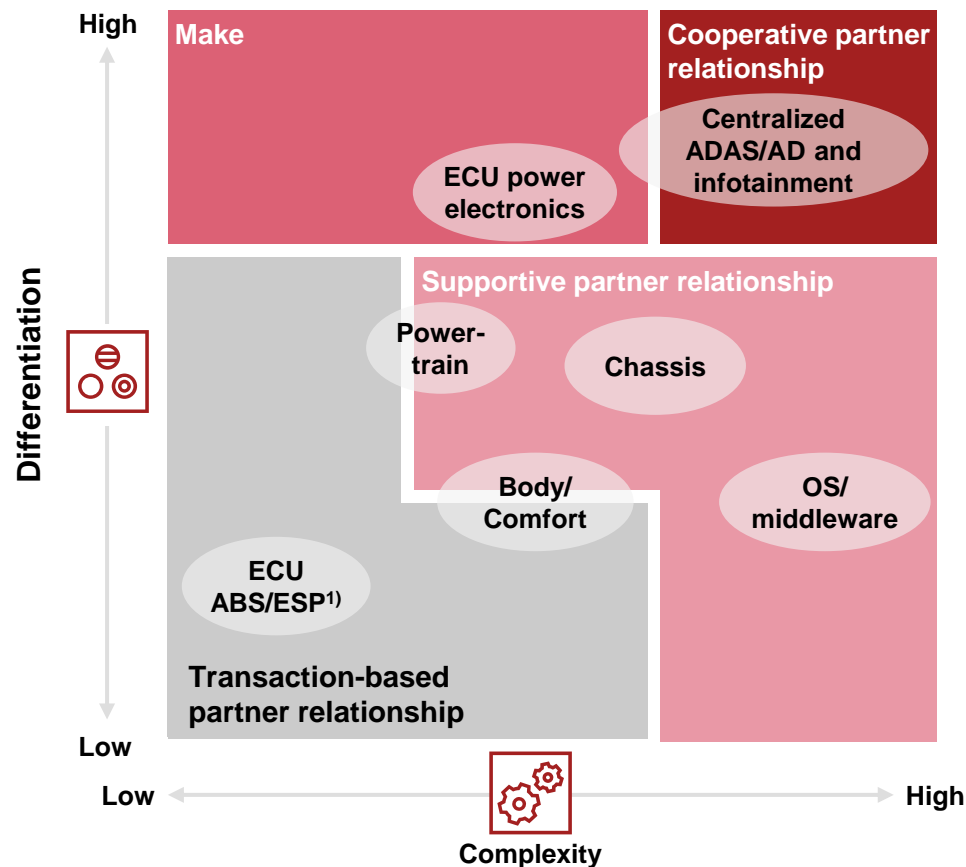
Exemplary partnering strategy elements

Make
► **Power electronics for specialized functionalities:** tailor solutions to vehicle architecture and performance requirements for brand differentiation, e.g., energy efficiency, range, thermal management, and system integration (powertrain domain)

Cooperative partner relationship
► **Centralized functions like ADAS/infotainment:** integrate tech and semicon partners in release train to address high complexity, and combine competences for sensor fusion, real-time processing, UI[2] design, and connectivity services

Supportive partner relationship
► **Powertrain** with high differentiation potential to optimize vehicle efficiency and performance based on available in-house capabilities
► **Enabler technologies** with limited differentiation potential (e.g., OS/middleware); open source may reduce time and cost without sacrificing differentiation
► **Chassis** on zone controller; software and architecture provided by partner (white box)

Transaction-based partner relationship
► **Functionality on separate ECU:** low differentiation for standards with low innovation content and need for upgradability such as ABS and ESP
► **Body** with low differentiation and complexity; component provided by partners
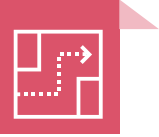
Tier-1 suppliers have the chance to proactively define the SDV ecosystem and cover differentiating parts of the SDV value chain

Suppliers' ways-to-play in the SDV era

Combinations possible

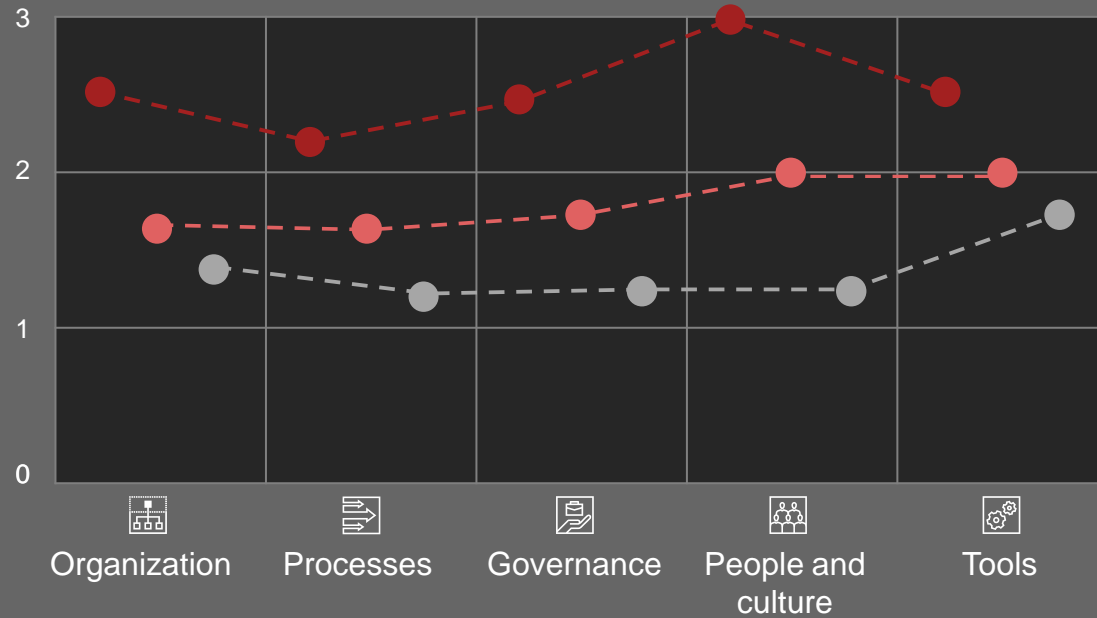|	**SDV platform provider** ("Horizontal play")	**SDV domain solution provider** ("Vertical play")	**Component specialist** (Tier-1 SW or HW)	**Design and develop as a service**	**Made-to-order producer**
Value proposition	Offers an **integrated, turn-key SDV platform solution** and **software layer** for OEMs	Offers **domain-specific** and **integrated hardware** and **software solutions** to OEMs	Offers **leading technology, special-purpose software** or **hardware** to OEMs	Offers **design, development, testing** and/or **homologation services** to OEMs	Offers **scalable made-to-order production** and **vehicle assembly services** globally
Differentiation	Ready-to-use **tech platform** that OEMs can augment incl. **dev. tools and consulting**	Ready-to-use, **integrated** and **homologated** domain-specific solutions	Highly **specialized compo-nents** requiring **significant domain know-how** or **scale**	Experienced **engineers** and **consultants** to **augment OEM teams** in developing SDVs	High expertise in **production** and **cost-down** incl. **supply chain supervision** and mgmt.
Competitive focus	Competes on **simplicity**, **value**, **completeness,** and constantly growing **platform scale**	Competes on **sophistication** and **functionality** of the **domain-specific solution**	Competes on **sophistication quality** or **cost** of **specialized hardware** component	Competes on **availability of experience, talent,** and **design** and **development know-how**	Competes on **production tech optimization**, **scale**, **global delivery** capabilities and **price**
SDV value chain	**Broad coverage across all SDV-differentiating steps** with **high in-house investments**	**Selective coverage** for **specific domains, partnering** for E/E development	**Narrow software or hardware-specific coverage** for development or material	Focus on **development activities** (specific or broad), **no component supply**	**Narrow coverage** in **vehicle definition,** focus **on scalable development and production**

SDV platform and domain solution provider involve the largest transformation needs for Tier-1 suppliers

Suppliers' implications on operating model

Strategy& capability profiler

Illustrative transformation need of a Tier-1 supplier

Capability gap based on an established Tier-1's existing capability set

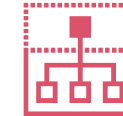Selected ways-to-play

SDV platform provider

SDV domain solution provider (Tier-1 domain)

Component specialist (Tier-1 SW or HW)

Chart axis: 0, 1, 2, 3 (vertical); Organization, Processes, Governance, People and culture, Tools (horizontal)

Differences in transformation need

Necessity for **centralized, full-stack organization** for platform provider; lower transformation need for **streamlined hardware-centric** component specialist

Gaps mainly driven by transformation towards **end-to-end processes** for **continuous integration, testing, validation,** and **digital twins** to enable rapid updates

SDV platform provider with **lean decision-making** as differentiator; domain solution provider and component specialist focus on **stack-specific integration**

Strong necessity for **software-first** and **innovation-focused culture**, while domain solution providers need **specialized tech talent within the domain**

Main difference in **maturity of tools** used for **continuous integration and development;** commonality in high **testing and validation** effort

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Legend: 0 = best-in-class, no transformation need, 1 = strong capabilities, low transformation need, 2 = some capabilities, medium transformation need, 3 = little capabilities, high transformation need; Source: Strategy& SDV capability profiler

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Given the rapid transition towards SDVs, automotive players must act quickly to secure their position along the value chain

Need for action

01 **Decide on an SDV strategy and market positioning**: Automotive players should develop a clear SDV strategy that considers core competencies, competitive positioning, and shared technology roadmaps to support their long-term positioning

02 **Shift from a global to a regional perspective:** Enable regional vehicle customization and react quickly to regional regulatory restrictions, e.g., in semiconductors, by leveraging the advantages of standardized SDV stacks with exchangeable layers

03 **Embrace hardware-independent software architecture**: OEMs should decouple software from hardware for continuous development and seamless third-party integration, using service-oriented, scalable, and hardware-agnostic software platforms

04 **Master partnerships:** Build and operate different partnership strategies according to the way-to-play configuration and E/E architecture – it is imperative to create real value by governing various partners at the same time efficiently

05 **Modernize development ecosystem**: OEMs and Tier-1 suppliers should adopt cloud-native toolchains and CI/CD[1] frameworks to support real-time software updates, starting with core engineering teams to ensure collaboration and lifecycle support

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Thank you