Your Presenter

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Elaine 目前担任 Omdia 的高级分析师，专注于汽车智能座舱领域的研究。她的工作深入探讨人机界面、驾驶辅助系统、车载连接技术以及用户体验，并对新兴技术如何影响新一代汽车的发展提供意见。在加入 Omdia 之前，Elaine曾在欧美Tier 1 公司负责业务发展工作，主要负责日本市场分析和技术趋势研究，挖掘日本市场的新商机。在此期间，她与日本政府、日本汽车制造商以及全球合作伙伴紧密合作，制定战略决策并提供产品创新意见。此外，Elaine 也在日系 Tier 1 公司参与了驾驶员监控和人机界面系统的研发工作，致力于提升用户体验并推动产品功能的不断优化，以应对日益加速的汽车技术发展需求。凭借在多个领域的经验，Elaine 积累了深厚的技术洞察和市场分析能力，为推动汽车行业创新提供宝贵专业意见。

Integrating digital cockpits in EVs for seamless user interaction and enhanced mobility

Elaine Chung | Senior Analyst, Smart Cockpit

Smart Cockpits

Evolution of Smart Cockpits

From traditional driver interface into an intelligent, integrated hub

- Integrates advanced hardware and software to create a seamless, intuitive, and interactive environment for both drivers and passengers.

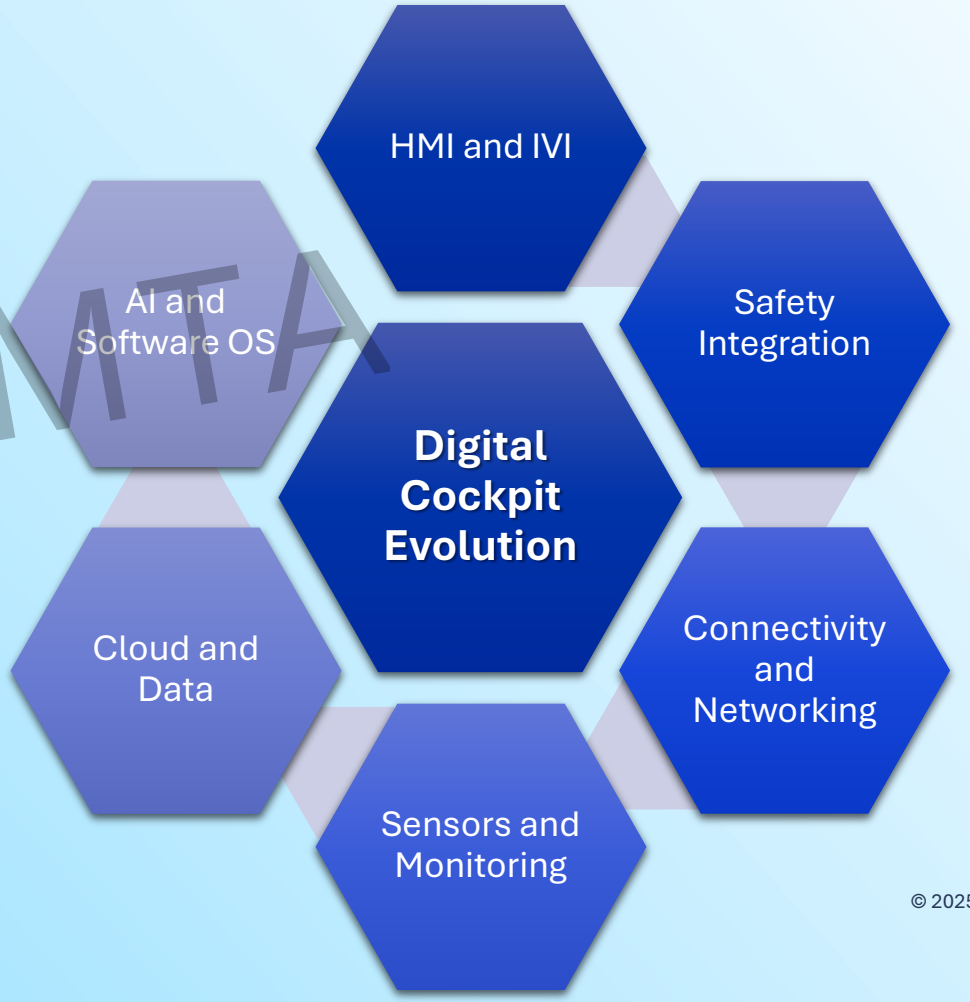
The transformation accelerated by technology shifts

- AI, cloud-based connectivity, and adaptive user interfaces are transforming vehicle design and functionality.

A key battleground for differentiation and value creation

- Rising consumer demands and stringent safety standards, significantly altering vehicle design and usage.

Key Technologies



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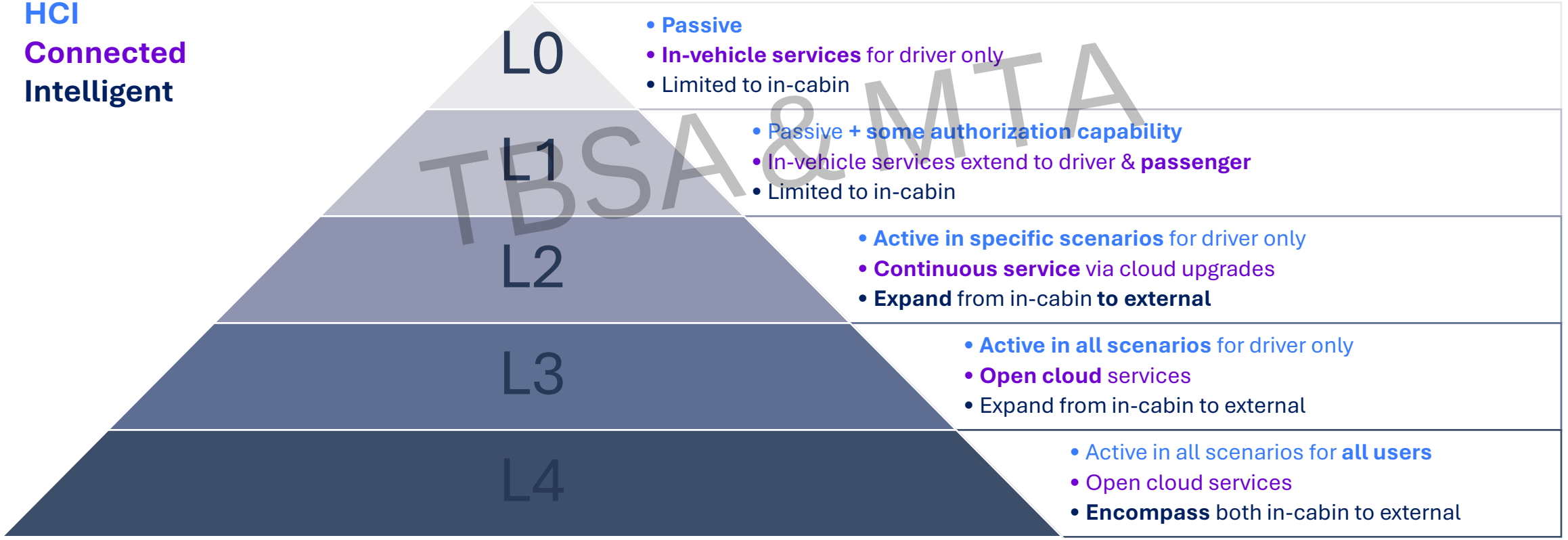
Intelligent Cockpit Level

“Whitepaper on Automotive Intelligent Cockpit Grading and Comprehensive Evaluation” -China SAE in 2023

HCI
Connected
Intelligent



Mapping the Cockpit Race

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Cockpit Innovation Scorecard: Benchmarking 20 Global OEMs

Market Positioning: Measure OEMs' performance by market share and growth to understand where they stand in the smart cockpit space.

Scalability & Cost-Effectiveness: Assess how well OEMs scale cockpit technologies across models and manage platform costs.

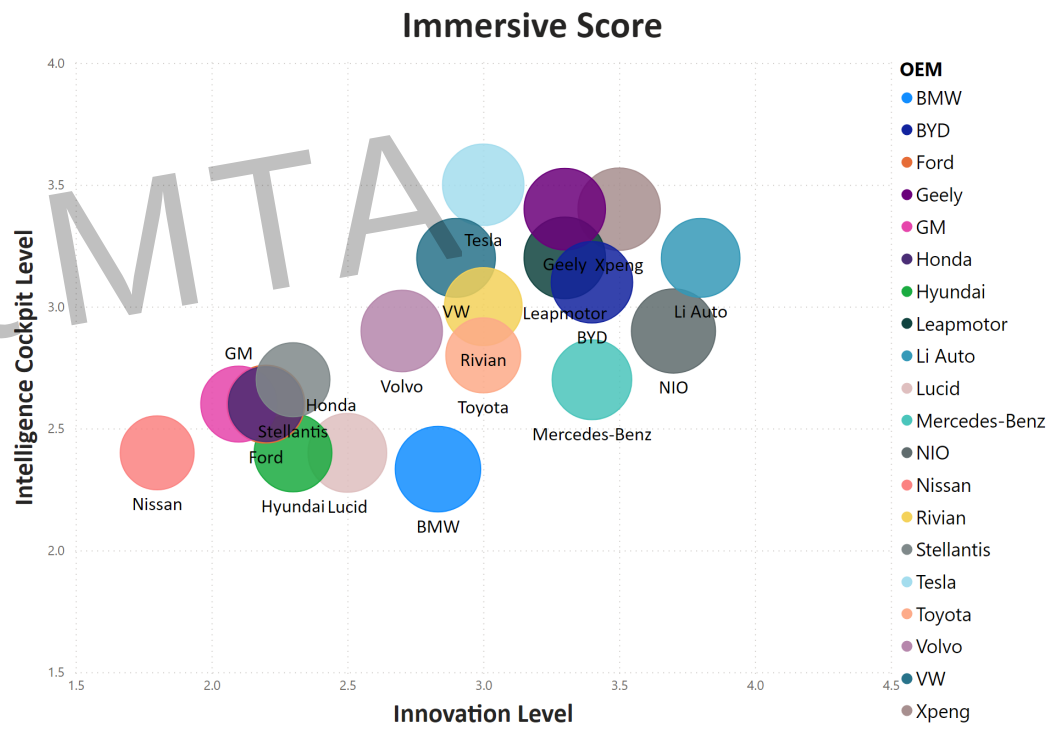
Innovation Pulse: Explore how OEMs innovate across usability, feature integration, and smart cockpit evolution.

Future-Readiness: Evaluate OEMs' tech roadmaps, upgrade plans, and partnerships to see how they're preparing for future trends.

Innovation & Technology: Immersive

Key Technologies/Components:

- ✓ ***Displays and Holographic Interfaces:*** Creates an engaging visual experience
- ✓ ***Interaction modalities:*** Provides information through touchscreens, voice and gesture controls
- ✓ ***Augmented Reality (AR)/Virtual Reality (VR):*** Enhances navigation, situational awareness and design/development processes
- ✓ ***Personalization and Customization:*** Allows users to tailor or automates the in-vehicle environment to user's preferences, including seat settings, climate control and infotainment options
- ✓ ***Ease of Use:*** Ensures that technologies are user-friendly and intuitive, making it easy for users to interact with and control while preventing driver distraction



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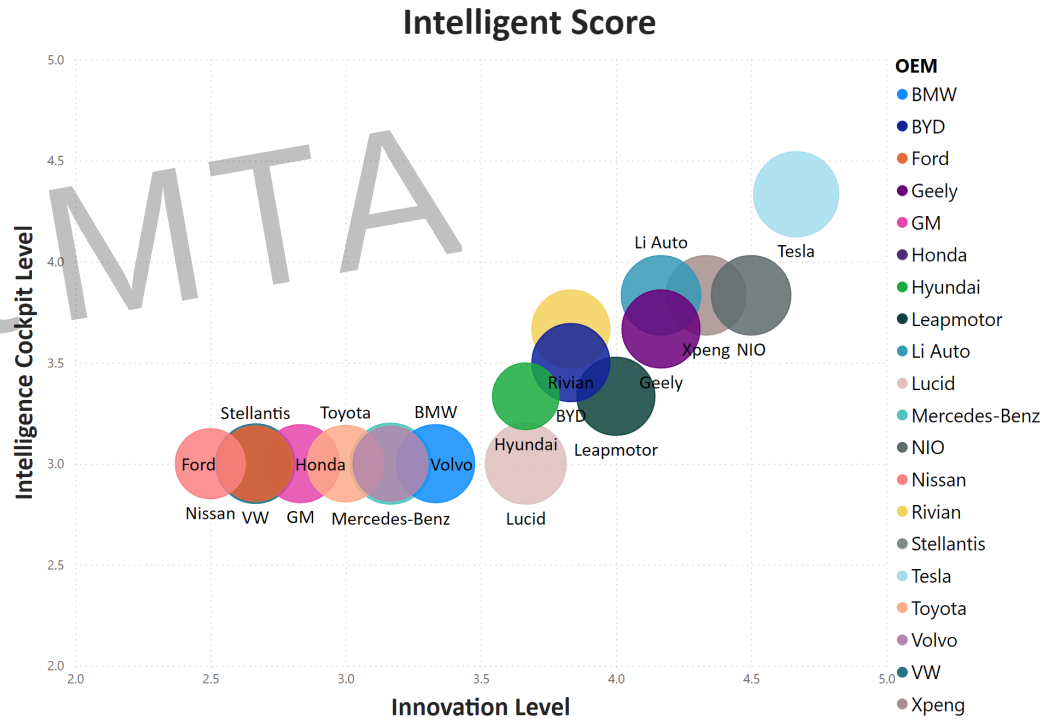
Innovation & Technology: Intelligent

Key Technologies/Components:

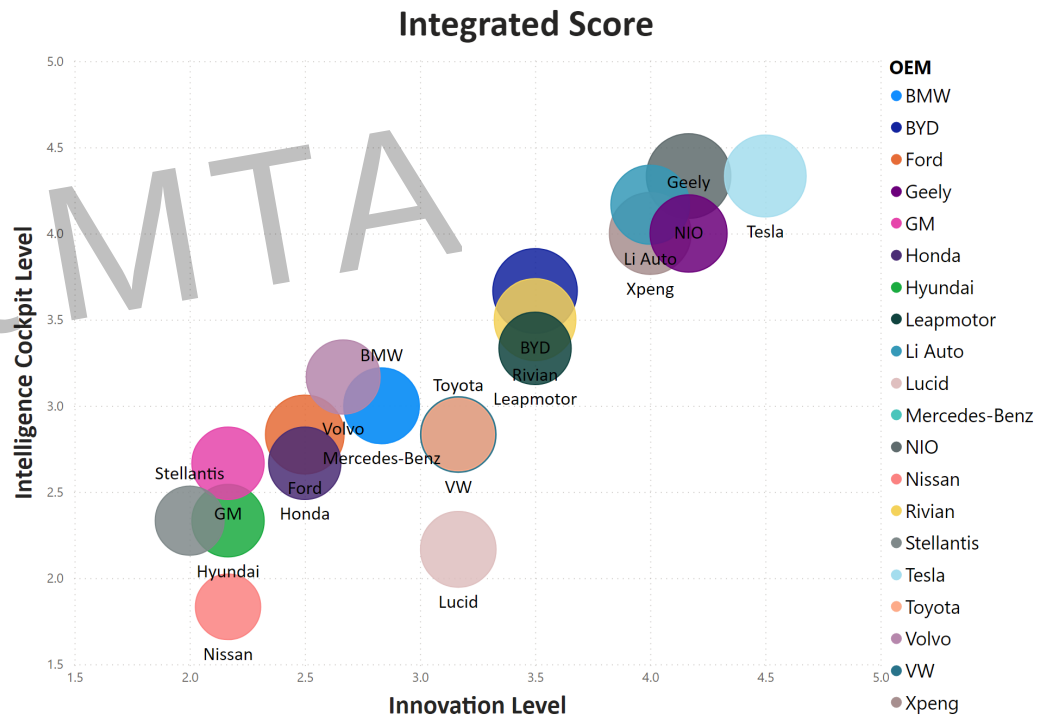
- ✓ ***Artificial Intelligence (AI):*** Generative AI, natural language processing that powers voice assistants and predictive systems
- ✓ ***Context Awareness:*** Sensors and systems that tracks in-cabin occupants' status and behaviors, and enables personalized settings
- ✓ ***Data analytics:*** Collects data to a cloud data hub and computing center, where it is used for training models and developing new functions based on data insights



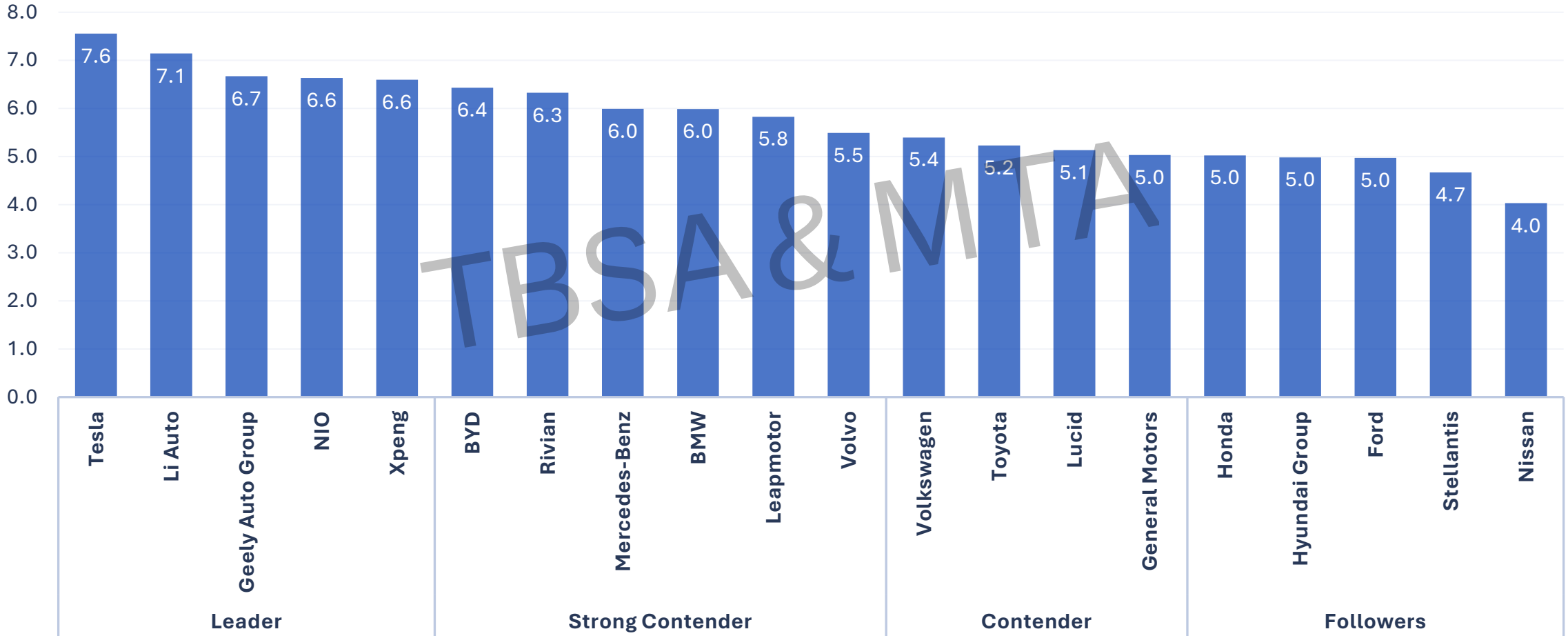
Innovation & Technology: Integrated

Key Technologies/Components:

- ***Software:*** Involves the integration of In-Vehicle Infotainment (IVI) Operating Systems (OS) and whole vehicle OS, ensuring deployment of various software applications and services
- ***ADAS Functions:*** Incorporates advanced driver assistance systems into cockpit, enhancing safety and convenience
- ***Computing Platforms:*** Centralized or domain computing to manage and process data efficiently within the edge or extending to the cloud
- ***Digital Ecosystem Integration:*** Connects the vehicle with external IoT devices, streaming services, and other digital ecosystems, enabling seamless interaction between the car and the outside world



Smart Cockpit Scorecard – Overall Ranking



Leaders

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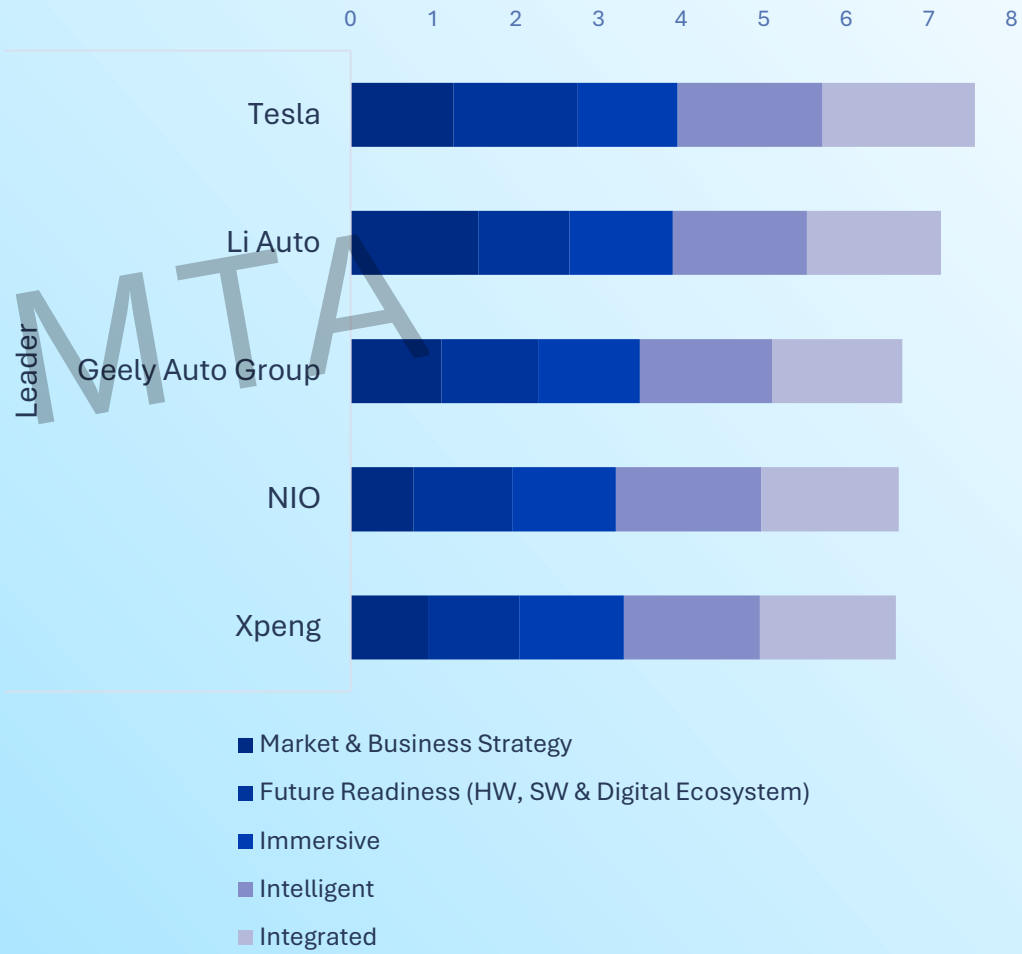
Leaders

Their strengths lie in advancements in in-car intelligence, AI-driven user experiences, hardware & software integration, and ecosystem connectivity. Notably, four of the top five leaders are Chinese automakers, reflecting China's leadership in reshaping smart cockpit technology.

Overall Ranking



Tesla

Key Features

- **AMD Ryzen-powered** IVI platforms
- 17” central touchscreen,12.3” driver display, 8” second-row display

Strengths

Future Readiness

✓ **Proprietary Operating System**
- In-house operating system features
- Optimized hardware-software performance

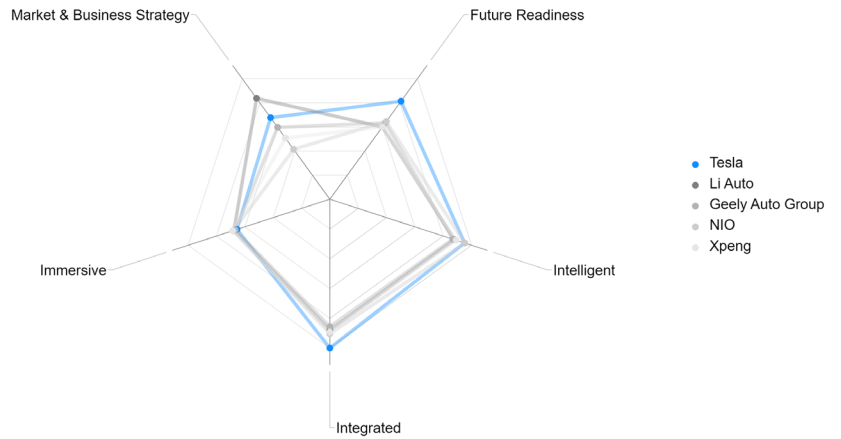
✓ **AI and Data Analytics Leadership**
- Proprietary Dojo supercomputer for AI training

I & T: Integrated

✓ **Full Self-Driving (FSD) Integration**
- Hardware 4 (HW4), elevated autonomous driving features
- Pioneer in approach to end-to-end AI for autonomy

Weakness – Market & Business Strategy

- **Optimize costs** to stay profitable despite price cuts
- **Invest in new technology** to maintain Tesla’s edge over Chinese competitors



Li Auto

Key Features

- **NVIDIA DRIVE Orin** powered latest L series
- **Upgrading IVI system**s with Snapdragon Elite in future models

Strengths

Market & Business Strategy

✓ **Established a strong domestic presence**
- Maintained significant revenue growth (~180% in 2023, ~17% in 2024) despite price pressures

✓ **Open-sourcing Halo OS**
- Following NIO's SkyOS, Li Auto is making Halo OS open-source to drive innovation, expand industry collaboration, and strengthens its competitive edge in cockpit software.

I & T: Immersive

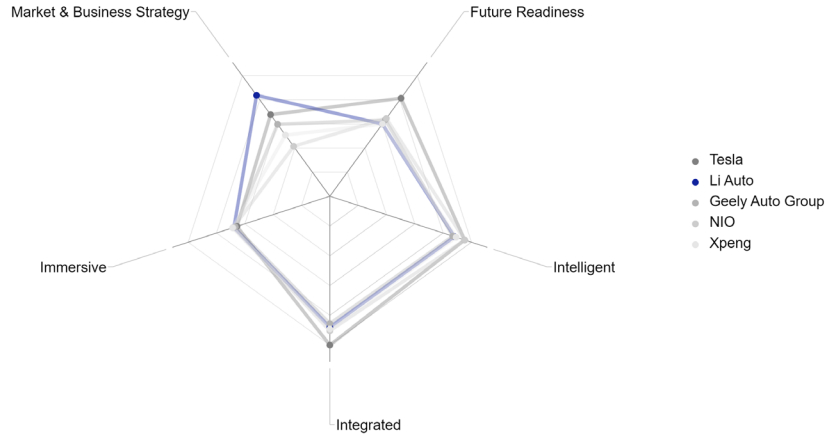
✓ **Five-screen 3D interaction**
- 3D Time-of-Flight (ToF) sensor for precise gesture controls, real-time cockpit perception, and seamless spatial interaction

✓ **AI-powered Assistance**
- MindGPT, a multimodal cognitive model built on NVIDIA TensorRT-LLM
- MindVLA , a dual-system architecture integrating end-to-end learning and Vision-Language Models (VLM)

Weakness – Future Readiness

- **Brand and ecosystem development** – Still building global recognition and industry partnerships, limiting influence abroad
- **Expansion and sustainability challenges** – Faces hurdles in entering international markets

Li Auto



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NIO

Key Features

- IVI systems run on SoC platforms - proprietary **NX9031 chip** and Snapdragon **SA8295P**
- **NVIDIA DRIVE Orin-based Adam supercomputer** powers cabin intelligence, autonomous driving, and OTA updates

Strengths

Future Readiness

✓ **Proprietary SkyOS**
- AI-driven system for SDVs, offering seamless access to navigation, media and settings

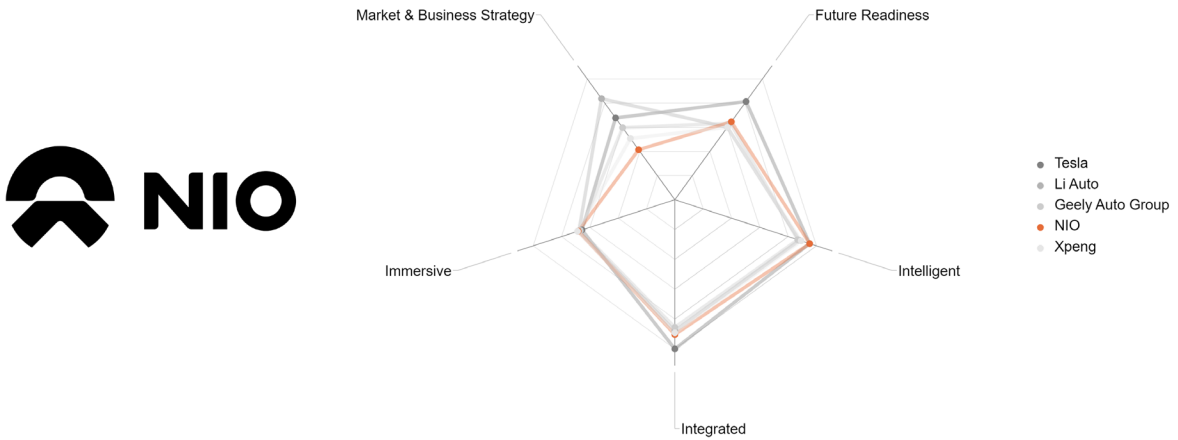
✓ **SDV architecture**
- Centralized control, high performance architecture, and scalability
- Seamless OTA updates, real-time AI execution capabilities

I & T: Intelligent

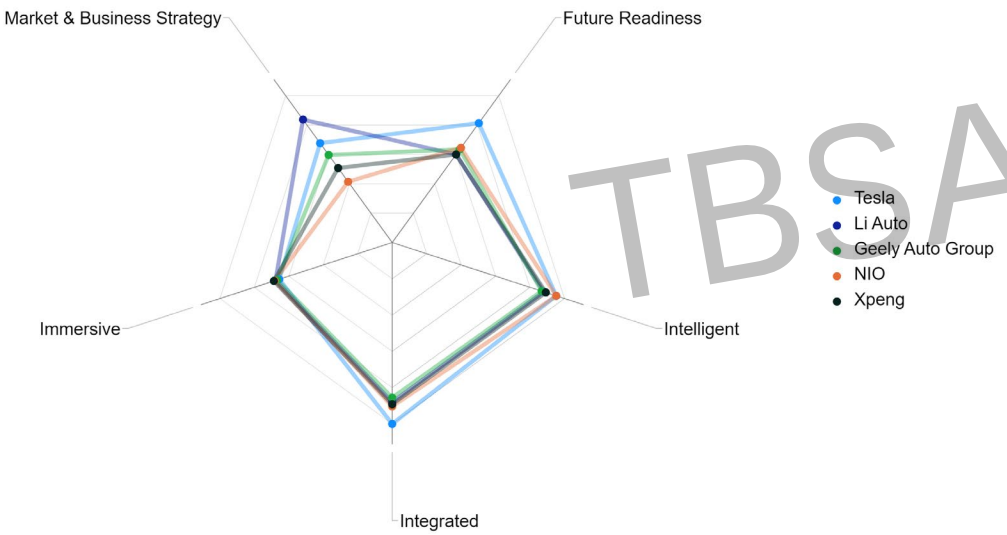
✓ **AI capabilities & Intelligent driving**
- NOMI GPT, an intelligent assistant capable of interactive Q&A and context-aware enabling cabin atmosphere master settings
- NIO World Model (NWM) uses multimodal autoregressive generative algorithms to simulate large amount of driving scenarios

Weakness – Market & Business Strategy

- **Cost pressures** – Rising operational expenses and investment-heavy strategies challenge profitability.
- **Revenue optimization** – Needs stronger monetization strategies to maximize returns from innovation.



Leaders: Across Key Categories



Chinese OEMs lead in innovation – fast tech adoption, strong in-house development, and competitive pricing.

- **Strengthening global strategy and business fundamentals is vital** – sustaining leadership depends on improving platform scalability, cost efficiency, and monetization of cockpit features.
- **Tesla stays ahead in software and cockpit integration** – faces pressure from Chinese rivals in market share and pricing.
- **Chinese leaders are investing heavily in intelligent systems** – AI models, centralized E/E architectures, and data-driven platforms.
- **Progress in integration is closing the gap** – in software, hardware, and ecosystems, Chinese OEMs are rapidly aligning. On the hardware side, there's push to achieve full localization (100% domestic chips) by 2026.
- **Ecosystem development is maturing** – with cockpit platforms tailored to local user needs, many are now working to expand globally.

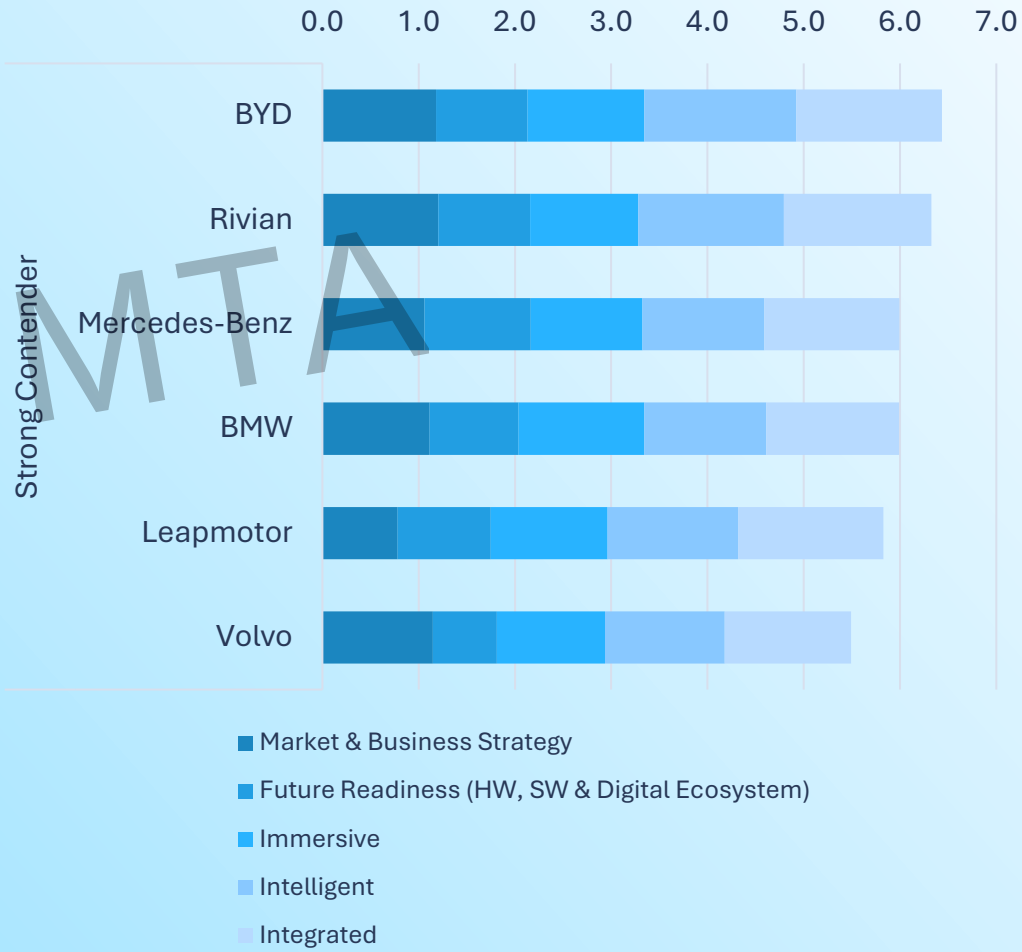
Strong Contenders

Strong Contenders

The ‘Strong Contenders’ group, is reimaging their technology stacks to increase competitiveness

- They prioritize **computing platforms** and **proprietary operating systems** to support seamless OTA and deliver personalized user experiences
- They leverage **strategic partnerships** to drive rapid advancements in connectivity, AI and autonomous driving capabilities

Overall Ranking



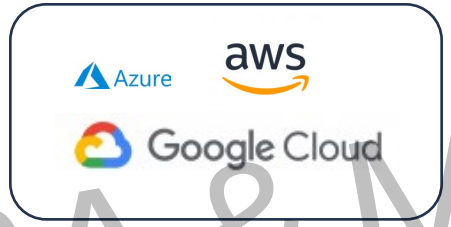
Computing platforms & Operating systems

BYD	RIVIAN	Mercedes-Benz	BMW	LEAPMOTOR
Custom computing platforms	**Vertically integrated system**	**IVI Platforms & HW integration**	**Next-generation hardware**	**Tailored SoC platforms & Central computing system**
• DiPilot 100, 300, 600 • Xuanji architecture for cross domains and AI models compatibility	• Snapdragon Digital Chassis • Dual NVIDIA DRIVE Orin • Zonal E/E architecture	• Qualcomm Snapdragon cockpit platforms • Architecture decoupled hardware-software integration	• Snapdragon Digital Chassis • Neue Klasse platform on scalable technology	• Qualcomm 8155, 8295, NXP S32G and NVIDIA Orin-X • Cross-domains platform • Optimized E/E framework
Proprietary SW & OS	**Proprietary SW & User-centric interfaces**	**Proprietary MB.OS & AI-driven personalization**	**Evolving iDrive OS**	**Proprietary OS**
•DiLink IVI Platform, built on an Android foundation	•In-house IVI SW, built on Android Automotive OS (AAOS)	• Scaling of MB.OS , a proprietary, chip-to-cloud OS, MBUX	•iDrive OS 9 built on Android Open Source Project (AOSP)	•In-house Leapmotor OS 4.0 offers an intuitive user interface

Strategic partnerships

- **AWS-Based Cloud Services**
  - Used AWS for connected vehicle platforms, OTA, and BYD app since 2023.
- **NVIDIA AI Collaboration**
  - Isaac™ and Omniverse™
- **Cloud shift to Google & Alibaba**
  - Began transitioning overseas cloud services

- **AWS & Databricks Integration**
  - Supported Rivian's Direct-to-Consumer (D2C) model with a unified data ecosystem
- **IVI ecosystem**
  - Expanded with support for Apple, Google Play, third-party apps

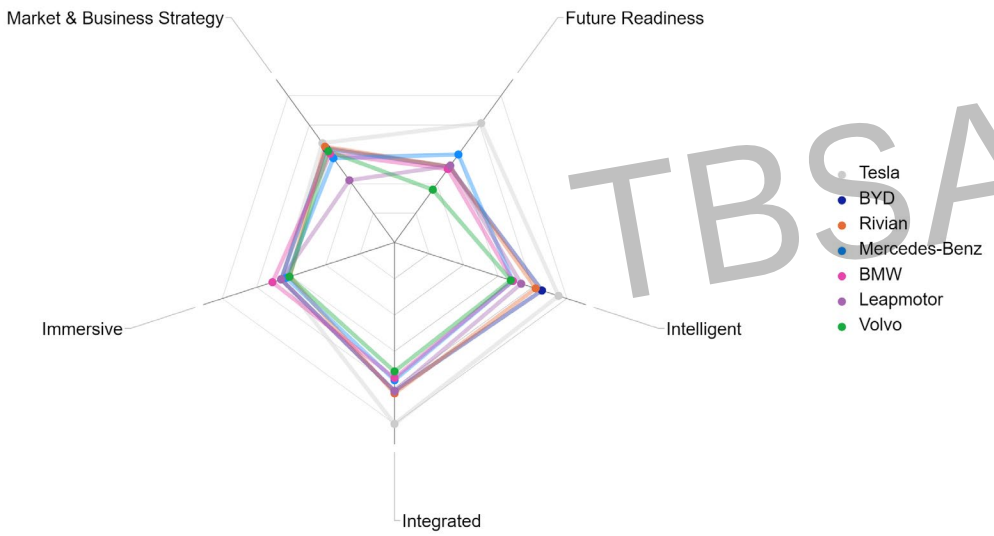


- **Azure AI & AWS cloud**
  - Partnered with Azure (2023-24)
  - Began IT transformation with RISE with SAP on AWS
- **MBUX 4.0 & Google Integration**
  - Virtual Assistant will be powered by Google Cloud AI
  - Enable direct third-party app installs via new Android API

- **AWS & ADAS**
  - Used AWS for cloud-based ADAS development and models training for predictive maintenance and customer experience

- **Vertical Integration & Global Expansion**
  - Collaborated with Stellantis, expanding into 13 European countries
- **IoV & Cloud-based services**
  - In-house enabling OTA updates, smart cockpit features, remote control and data analytics

Strong Contenders: Across Key Categories



OEMs are investing in software and partnerships to reinvent the in-vehicle experience.

- **Starting to build proprietary OS and in-house software** – most are only now launching platforms like MB.OS and Neue Klasse to take control of the software stack.
- **Using strategic partnerships to catch up fast** – instead of going fully in-house they collaborate with tech companies to accelerate AI, connectivity and autonomy prioritizing speed to market.
- **Modernizing vehicle architectures** – moving toward centralized compute and zonal architecture to support OTA updates and reduce complexity.
- **Closing the gap in user experience and digital services**– ramping up AI assistants, immersive cockpits, and cloud-based features.
- **Overcoming scale and operational challenges** - addressing production scalability and operational efficiency remains major hurdles, especially for newer entrants like Rivian and Leapmotor.

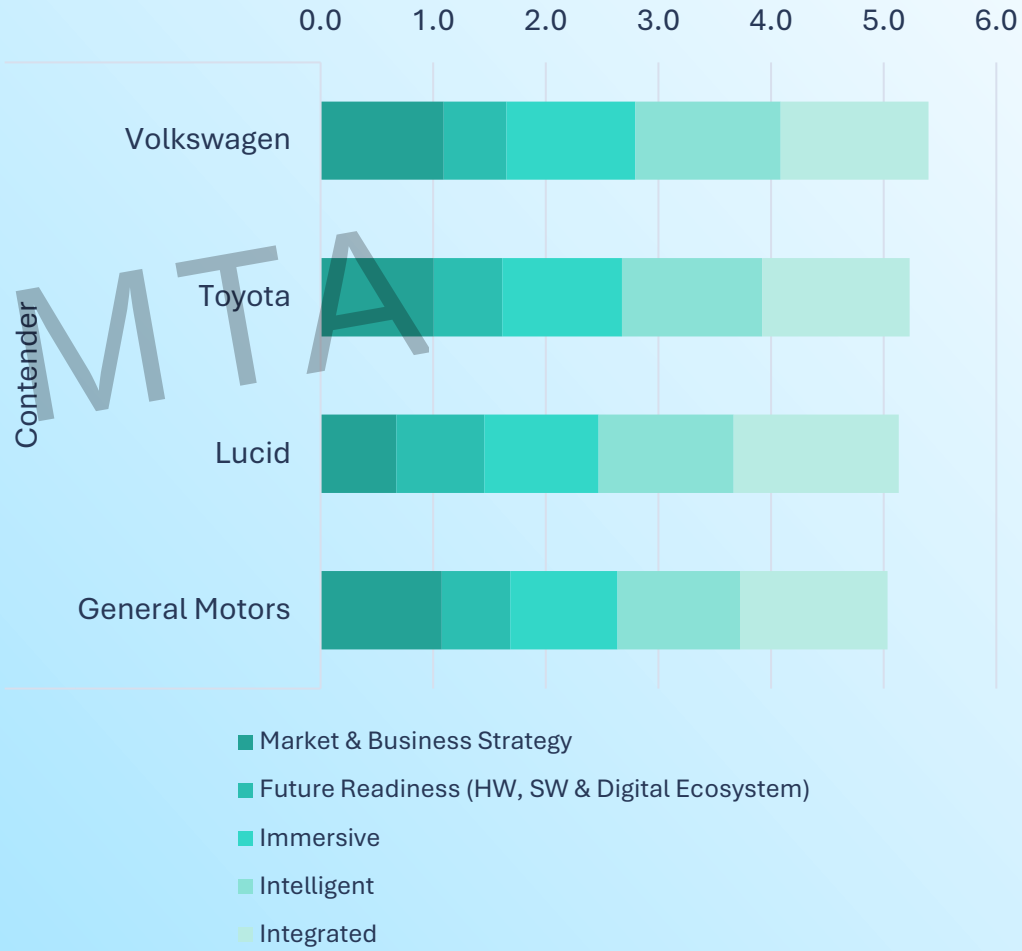
Contenders

Contenders

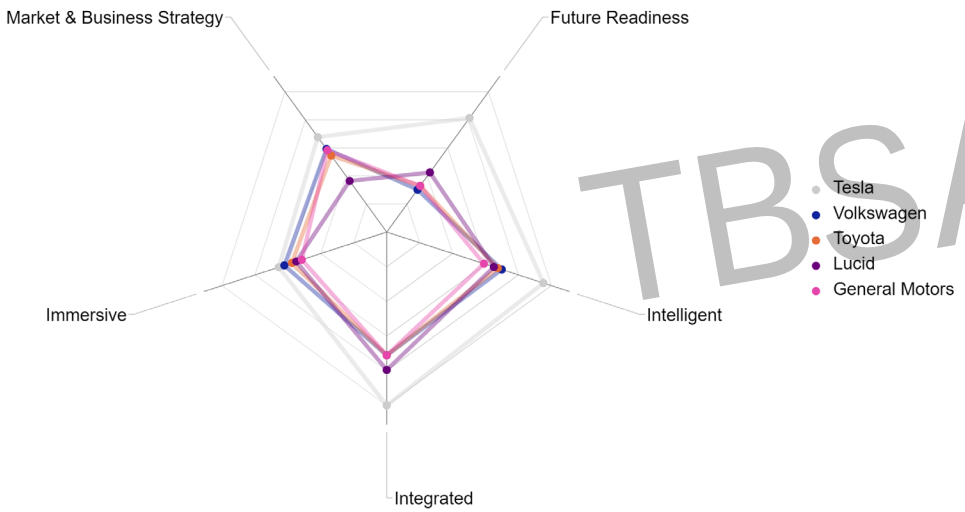
The **"Contender Group“** is actively focusing on the development of smart cockpit technologies.

- These companies are leveraging:
  - **Proprietary platforms**
  - **AI integration**
  - **Strategic partnerships** to compete in an evolving automotive landscape
- Despite these efforts, they are currently **ranked below leading players** due to ongoing challenges in:
  - **Market performance**
  - **Scalability of solutions**
  - **SDV readiness**

Overall Ranking



Contenders: Across Key Categories



Advancing toward smart cockpit capability, yet facing headwinds in scaling, delivery, and platform readiness.

- **Investing in proprietary platforms but staring late** – building and scaling up in-house operating systems (VW.OS, Arene OS, Lucid UX, Ultifi) to gain control over software and enable OTA updates.
- **Relying on strategic partnerships to accelerate** – leveraging partnerships to speed up AI integration, cloud connectivity and cockpit innovation.
- **Facing execution and scalability challenges** – despite strong tech ambitions, this group struggles with software delays (VW), organizational restructuring (Woven by Toyota), production scale (Lucid), and SDV rollout pace (GM).
- **Positioned to compete, but still catching up** – each company brings unique strengths, VW's global scale, Toyota's reliability, Lucid's premium UX, and GM's ADAS leadership, but they must overcome internal and external hurdles.

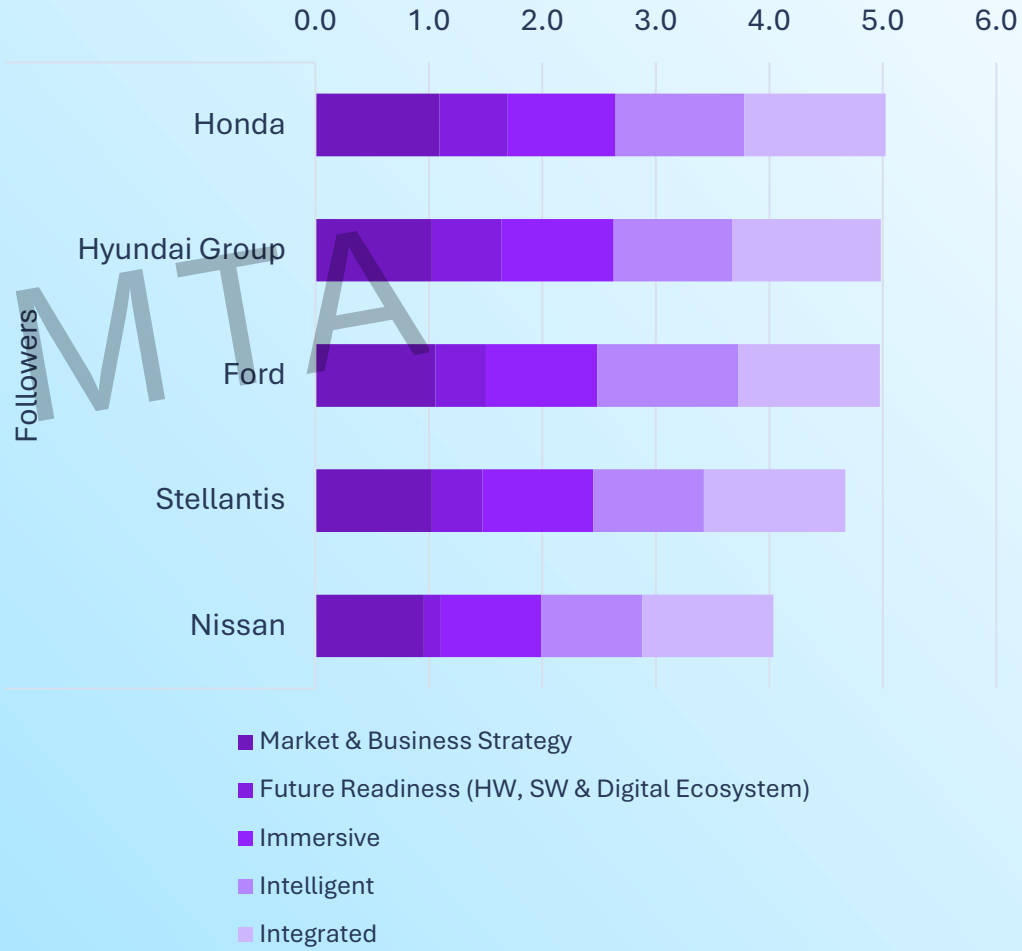
Followers

Followers

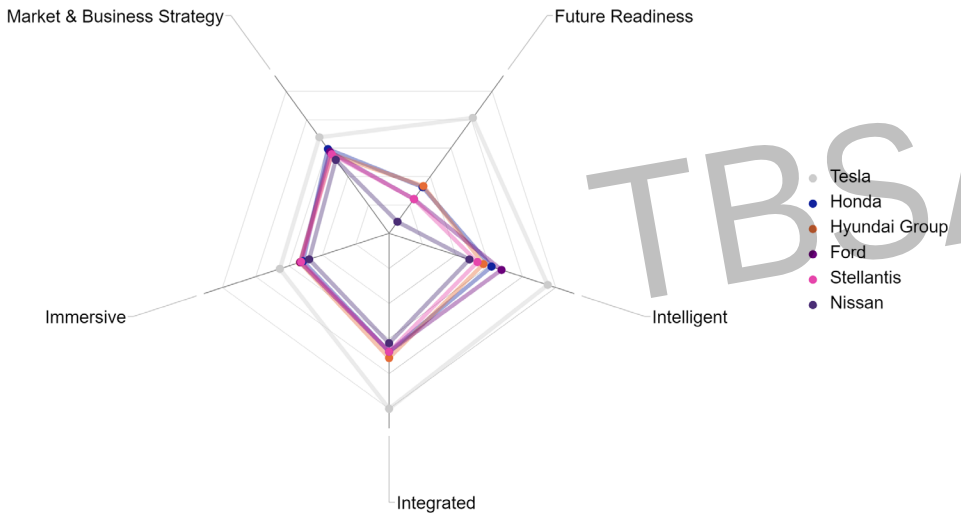
The “Follower Group” has made notable advancements in smart cockpit technologies.

- Each faces distinct challenges in:
  - **Technological development**
  - **Market strategy**
  - **Operational execution**
- These challenges collectively impact their **competitive performance** in the evolving smart cockpit landscape.

Overall Ranking



Followers: Across Key Categories



Progressing in smart cockpit innovation, but trailing in software scale and strategic execution.

- **Progress in smart cockpit features** – introduced innovations like AAOS integration, UI innovation (Ford's panoramic screen), and AI-powered infotainment (Hyundai's SmartThings), but mostly through third-party platforms rather than proprietary system.
- **Limited software ownership** – relies on external tech providers, slowing their ability to differentiate and evolve cockpit experiences.
- **Execution and scalability challenges** – delays (Stellantis SmartCockpit setbacks), fragmented strategies, and slower platform rollouts have hindered their ability to scale across models and markets.
- **Gaps in strategic alignment** – inconsistent investment in software platforms, user experience design, and operational integration has kept them behind more software-first competitors.

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Thank you!

Open to feedback and collaboration as we shape the path forward together!

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