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UNLOCKING R&D PERFORMANCE

Streamlining the Operating Model for the Software-Defined Vehicle

CONTENT

EXECUTIVE SUMMARY

WHY now is the time to act

The rise of software-defined vehicles (SDVs) is reshaping the economics of the automotive industry. Software has become the primary driver of differentiation and profit, while digital-native OEMs, particularly from China, set the benchmark with weekly OTA releases, vertically integrated organizations, and cost structures that are up to 40% lower than those of their legacy peers. An example of this can be seen in the quadrupling of the market share of Chinese OEMs in Europe since 2020. Without a fundamental redesign of their R&D operating model, incumbents risk not only falling behind but also becoming irrelevant.

WHAT it takes is a dual transformation of the operating model

Winning in the SDV era depends on two essential shifts: First, a strategic transformation that aligns the operating model with SDV-driven product strategy, and second, an operational transformation that delivers speed and efficiency by simplifying structures, accelerating workflows, and optimizing workforce setup. The SDV.OM (Operating Model) Framework, developed by Berylls by AlixPartners and the Institute of Technology Management at the University of St. Gallen, builds on insights from leading industry executives and provides practical guidance for assessing and transforming R&D operating models. Structured around six key dimensions and corresponding 18 action fields, it focuses on the KPIs that truly matter. This enables fact-based performance baselining and direct benchmarking against SDV front-runners.

HOW to turn strategy into measurable performance

The SDV.OM Framework provides a clear path to steer the dual transformation of R&D organizations. The process begins with preparation, involving the alignment of key decision-makers and the establishment of a validated fact base across the six operating model dimensions. It continues with analysis, benchmarking against SDV front-runners to expose the execution gaps that matter most. Finally, it drives transformation by closing these gaps with targeted measures, clear ownership, and continuous steering via the SDV.OM Framework. Applied with discipline, the playbook enables CTOs to turn strategy into measurable R&D performance.

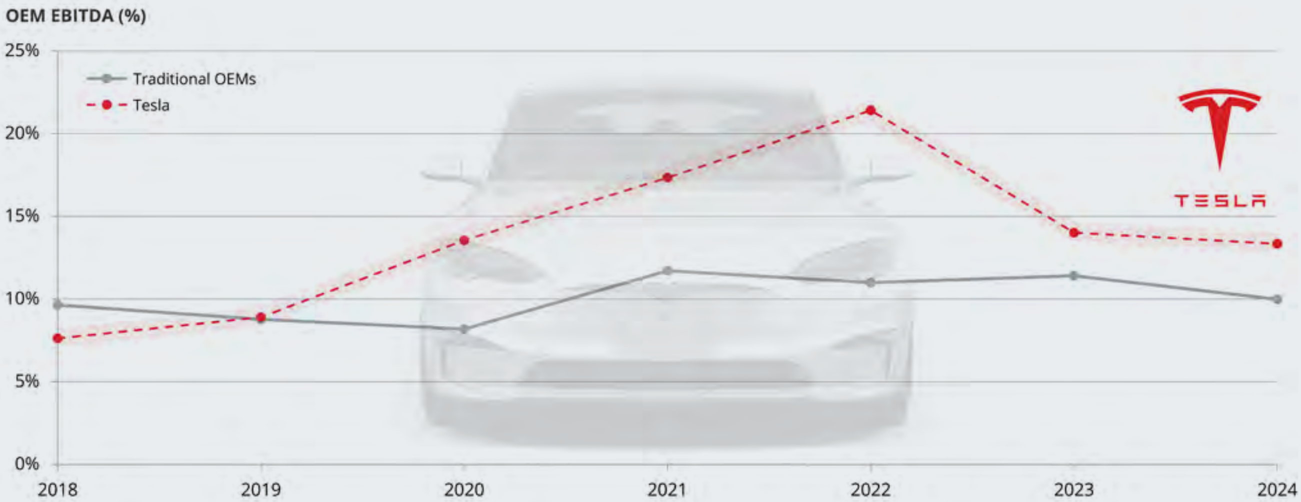
1

NAVIGATING THE DUAL TRANSFORMATION IN R&D

Over the past decade, the automotive industry has experienced a seismic shift, a transformation that has shattered traditional paradigms of vehicle design, development, and delivery. While the roots of this shift trace back further, Tesla's launch of the Model S in 2012 served as a catalytic moment. More than an electric vehicle, it embodied a new paradigm: The car as a software-defined platform. Tesla's integration of centralized computing, over-the-air (OTA) updates, and a vertically integrated digital stack didn't just disrupt conventional engineering, it reset the strategic direction for the entire industry. Today, OEMs across the globe are racing to emulate and evolve beyond this model, as software becomes the primary driver of a vehicle's value and differentiation. According to a board member of a global manufacturer, OEMs that fail to adapt within the next five years may not just fall behind – they could disappear altogether.

FIGURE 1:
TESLA MANAGED TO OUTPERFORM TRADITIONAL OEMs IN PROFITABILITY

Profitability (EBITDA Margin %, Top 30 OEMs)



Source: AlixPartners Global Automotive Outlook, 2025

Overall, software has become the defining factor of automotive innovation, fundamentally shifting the product strategies of OEMs. Modern vehicles are expected to contain over 650 million lines of code – far exceeding the 20–40 million lines in a smartphone or fighter aircraft[1]. But while sheer code volume is staggering, the real disruption lies deeper: Delivering next-generation digital experiences, from autonomous driving to immersive infotainment, requires a fundamental redesign of vehicle architectures, with software at the core. This transformation is accelerating the industry's shift toward **software-defined vehicles (SDVs)** – vehicles whose core value is primarily created and delivered through software, rather than mechanical performance or hardware engineering.

Although proprietary software remains a key differentiator, open-source software (OSS) is playing an increasingly strategic role. A well-known example is Google's Android Automotive OS (AAOS). Once fiercely resisted by many OEMs, it has quietly become a de facto standard in the industry, demonstrating how platform

1 Goldman Sachs, 2022

adoption can outpace internal resistance when scale and developer ecosystems align. Beyond AAOS, Open Source Software (OSS) is rapidly emerging as a CTO-level lever to reduce R&D costs, accelerate development, and refocus scarce engineering talent on true differentiators, instead of reengineering commodity code.

Following Tesla's lead, a new wave of **digital-native OEMs** emerged, most notably NIO with its launch of the ES8 in 2018. More than a premium EV, the ES8 introduced NOMI, the industry's first intelligent in-car AI assistant. This was not merely a novelty, it marked a shift in how the cockpit was conceived: Not as a static control space, but as an intelligent, continuously evolving digital driver interface. Chinese OEMs such as NIO, XPeng, and BYD have since become formidable players by leveraging rapid software iteration cycles, vertically integrated supply chains, and aggressive pricing strategies. Enabled by a favorable policy environment and deep investments in in-house software platforms, many of these players now release OTA updates at a pace unmatched by traditional automakers, often weekly or monthly. A Senior Vice President of a German OEM highlights that while digital-native OEMs are normalizing in-car AI and lightning-fast updates, most established OEMs treat such advancements as tomorrow's vision.

FIGURE 2:
DIGITAL-NATIVE OEMs ARE EXPECTED TO BECOME THE NEW PROFITABILITY LEADERS

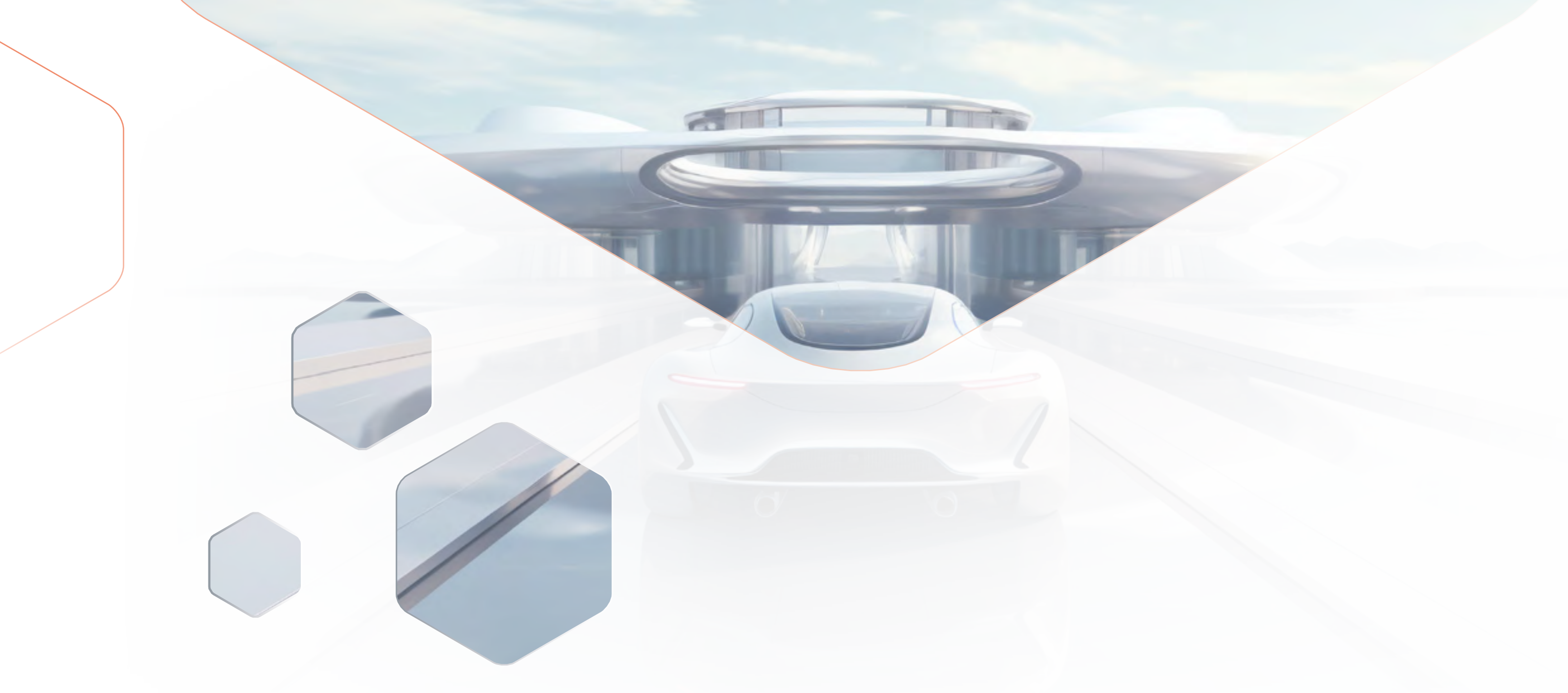
Top 5 OEMs ranked on change in economic profit ($ billions, 2024A-2027F, Consensus Forecasts)[1-4]

	BRAND	EXPECTED EP GROWTH 2024 - 2027
1	Tesla	3.8
2	BYD	3.1
3	Rivian	2.7
4	Volkswagen	2.3
5	Nio	2.0
	All other	-14.3

1 As of May 21st, 2025; 2 Financials based on 33 OEMs; 3 Forecasts per analyst consensus estimates, all years converted to USD at constant F X rate; 4 Economic Profit (EP) = Adjusted / Non-GAAP net income – [charge (Ke) x equity capital]; excludes intangibles Sources: FactSet, AlixPartners Analysis 2025

Despite macroeconomic headwinds, geopolitical tensions, and ongoing consolidation, **Chinese manufacturers** continue to gain ground, nearly quadrupling their EU market share from 2% in 2020 to 7.7% by 2023[2]. In many cases, these players benefit from production costs that are 30—40%[3] lower than those of legacy OEMs, while still matching, or even surpassing, them in terms of digital features and update frequency. This has reshaped the global competitive landscape, forcing incumbents to rethink their speed-to-market, cost structures, and software strategies. The COVID-19 pandemic further accelerated this transformation, empowering technology-driven entrants to redefine customer expectations. These newcomers delivered cutting-edge software features and introduced innovative value creation models, underscoring the fact that traditional vehicle development approaches need to be fundamentally reimagined, particularly by former market leaders.

2 ACEA, 2024; 3 European Parliamentary Research Service, 2024



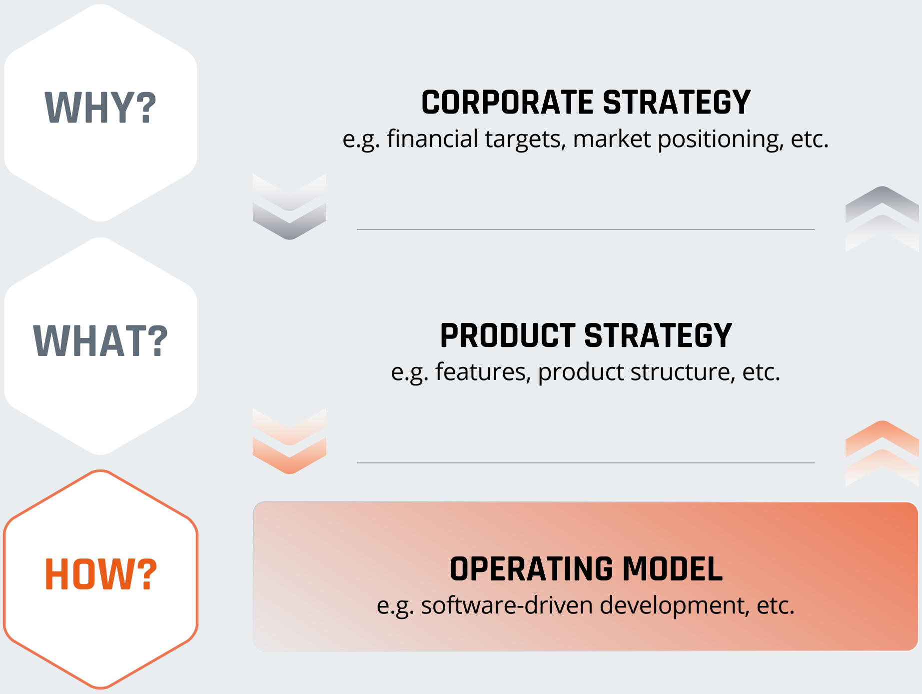
As the product strategies of OEMs evolve, the key strategic question for automotive executives is "What digital experiences do we deliver, and how do we scale them efficiently?". As software becomes the primary source of differentiation and customer value, the transformation extends far beyond the vehicle itself. It demands a fundamental redesign of OEMs' organizations and core processes, i.e., **the operating model.** In response, OEMs are making substantial investments in internal software capabilities, building up their own digital platforms, tech stacks, and engineering organizations. This pivot, however, often comes with sharply rising development costs and increased complexity. Legacy OEMs now face the dual challenge of modernizing their product and organizational architectures while remaining cost-competitive with more agile, digital-native entrants. The uncomfortable truth: According to a recent Berylls by AlixPartners analysis, not a single legacy OEM has yet cracked the code on a truly software-driven operating model. Therefore, the race is on and those who don't catch up risk being left behind.

One key lesson for CTOs and R&D leaders in recent years: The SDV is not primarily a short- to medium-term revenue engine, but a critical enabler for driving efficiency gains, reducing complexity, and lowering R&D costs. Initial ambitions to monetize SDV features through subscriptions and digital services have often fallen short of expectations, highlighting the complexity of turning software innovation into profit. Instead, the immediate priority is ensuring that SDV development is both scalable and cost-efficient. To achieve this, OEMs must undertake a **dual transformation** of their R&D operating model, ensuring they can effectively enable their SDV product strategies:

- **Strategic Transformation:**
  Redefining the R&D operating model toward a target model in order to align with a dedicated (SDV-based) product strategy, thereby enabling software-driven development while accommodating critical legacy constraints such as shared processes and tools.
- **Operational Transformation:**
  Enhancing efficiency and a lower cost structure within the R&D operating model by simplifying structures, accelerating workflows, and optimizing workforce setup.

While some executives may argue that both transformations can occur simultaneously, experience shows that this approach often overwhelms organizations. The reason is simple: The goals of these two transformations are inherently contradictory. On one hand, new software-related capabilities must be developed and scaled. On the other, cost discipline is essential, often requiring workforce optimization or tighter budget controls. Balancing these opposing objectives requires clear priorities, disciplined execution, and a phased approach. Consequently, this dual transformation is not optional. It is a strategic imperative for OEMs seeking to remain competitive in a market increasingly dominated by software.

FIGURE 3:
HOW CORPORATE AND PRODUCT STRATEGIES SHAPE THE OPERATING MODEL



DESIGNING THE NEXT GENERATION R&D OPERATING MODEL

To successfully navigate the strategic transformation toward SDVs, automotive OEMs must design an R&D operating model that directly aligns with their product strategy. This alignment is critical because the operating model is the engine that enables the development of SDV products, allowing OEMs to deliver software-driven features efficiently and at lower cost.

However, unlike agile technology startups, most OEMs cannot build their R&D functions from scratch due to legacy constraints, such as established steering committees and entrenched governance practices. "Several OEMs have already learned the hard way," notes the Head of Software Development at a leading German OEM, "that copying Tesla's R&D setup without adapting it to their own legacy constraints often leads to skyrocketing costs – and little measurable impact."

FIGURE 4:
SIX KEY DIMENSIONS TO STRUCTURE THE OPERATING MODEL

The challenge, therefore, is to zoom out, recognize these constraints, and actively minimize their impact when designing the next-generation R&D operating model. By reducing unnecessary compromises and focusing on software-driven excellence, OEMs can establish a model that balances innovation with operational discipline, positioning them for success in a rapidly evolving market.

This transformation directly impacts the six key dimensions of the R&D operating model: Governance, Processes (Product Planning and Development), People, Organization, and Infrastructure. Leading OEMs that align their operating model maturity with their SDV strategy show stronger performance in terms of speed and cost efficiency than their peers. These leaders demonstrate that the right operating model is not one-size-fits-all but a tailored evolving construct. Insights gained from a broad set of executive interviews, as part of the joint work between the Institute of Technology Management at the University of St. Gallen and Berylls by AlixPartners, reveal distinct transformation pathways across the key dimensions of the operating model:

Governance – Rigid, cost-centric control of single-vehicle projects is shifting to more value-driven approaches, whereby within SDV operating models, manager incentives are tied to successful feature launches and real customer impact, not just budget adherence. Particularly, decision-making has become faster, with steering committees minimized to the essential few, focusing on competency rather than legacy roles. Only those with direct expertise participate, ensuring fast and informed decisions, following the principle of subsidiarity. Collaborative development with industry partners and tech players is shifting away from rigid, OEM-specific projects toward shared standards and open-source collaboration. This enables OEMs to lower investment in non-differentiating areas and focus resources on delivering real customer value.

> Legacy steering cascades slow down innovation. OEMs need lean governance that puts real experts at the table and accelerates decisions where it matters most."
>
> Advisory Board Member of a German OEM

Planning and Development Processes – Rigid, vehicle-led planning and development processes are transforming into agile, platform-driven approaches. More specifically, in product planning, the business case no longer ends at the production line; it spans the entire vehicle life cycle. This means OEMs can now better justify features that generate value over time rather than demanding immediate profits. As a result, budgeting logic must evolve accordingly, shifting from one-time project funding to life cycle-based investment steering, with shared accountability for performance across SOP and post-SOP phases. Additionally, instead of numerous rigid, predefined requirements, SDV leaders focus on core foundational requirements, collaborating with partners to iterate and refine features continuously.

In product development, the shift is from strict, sequential cycles, where hardware and software development are tightly intertwined, to a fast, decoupled, agile model. Thereby, hardware evolves on its own timeline, while software is continuously updated based on scalable software platforms. Additionally, development adopts a fast-fail approach: Features are quickly launched, tested directly with users, and refined in rapid iterations. Release cycles are measured in days or weeks, not months or years – transforming speed into a competitive advantage. In the past, process quality was treated as the main driver of product quality, leading to strict adherence to frameworks such as ASPICE. But in today's SDV landscape, these standards should support, not dictate, development. OEMs must shift from box ticking to outcome-driven thinking, where speed, iteration, and engineering ownership drive real quality.

> We can't afford to wait nine months just to kick off a single vehicle project. By then, the market has moved on."
>
> Chief Technology Officer of an Asian OEM

People – Focusing on the workforce, the way OEMs acquire, develop, and lead their talent is undergoing a significant shift, too. The talent model is evolving from managerial orchestrators, where value is defined by tenure, coordination, and rigid processes, to technology entrepreneurs. In many OEMs, nearly 80% of employees work in management roles, focused on oversight rather than direct value creation. But in the SDV era, value comes from software development and rapid problem-solving. OEMs must attract and cultivate talent with both technical expertise and strategic vision, empowering employees to innovate, take calculated risks, collaborate with partners, and make fast, high-impact decisions.

> We don't need more managers. We need more makers.
> In the SDV era, value is built in code, not coordination."

SVP for Engineering at European Tier-1 Supplier

Organization – The organizational structure is shifting from rigid, domain-based engineering silos, whereby departments are traditionally aligned around functions such as R&D, Production, and Sales, to agile, cross-functional development teams. Instead of siloed structures focused on specific vehicle domains, agile teams are organized by competencies (e.g., software development) and products (e.g., platform or feature groups), fostering faster innovation and adaptability.

Leading OEMs are experimenting with SDV operating models by starting small, creating an agile sandbox with a compact nucleus team to validate agile practices. These teams are deliberately lean, cutting traditional hierarchy levels from 10-12 to just 3-4, significantly speeding up decision-making. This approach not only accelerates the development cycle but also creates a blueprint for scaling agile methods across the organization. For CTOs, this means reimagining organizational structures as adaptable, scalable systems that can rapidly respond to market changes.

> You don't build the future with twelve layers of approval.
> Leading OEMs are proving that three agile teams
> can do what thirty departments used to – faster, leaner,
> and closer to the customer."

Vice President for Software Development at European Tier-1 Supplier

Infrastructure – Disconnected Toolchain, where development tools are fragmented, poorly integrated, and minimally automated, are evolving into a fully integrated software factory. In traditional setups, data is scattered across systems, accessible only upon request, creating bottlenecks and slowing innovation. In the next-generation model, a unified toolchain spans the entire vehicle life cycle, from design and development to production and post-launch services. Automation is at the core, powered by DevOps practices, enabling rapid software deployment, continuous testing, and seamless updates. This integrated approach not only accelerates development but also ensures traceability, quality, and scalability. For CTOs, this means moving from a patchwork of disconnected systems to a streamlined software factory in which every update is traceable, automated, and instantly deployable.

> You can't ship weekly updates with 15 disconnected tools. A true SDV software factory integrates the entire toolchain, enabling 50% faster releases and full traceability from code to car."
>
> Chief Executive Officer at a Global Software Engineering Firm

The transformation of R&D operating models is not just a matter of adopting new processes or tools, it is a fundamental shift in mindset, structure, and apability. As automotive OEMs transition to SDVs, they must redefine their governance, processes, people, organization, and infrastructure to align with a software-first future. Those that embrace this multi-dimensional transformation will not only enhance efficiency and speed, but also position themselves as leaders in an increasingly software-driven industry. The choice is clear: Adapt proactively or risk becoming obsolete.

3

MEASURING WHAT REALLY MATTERS AND UNVEILING R&D PERFORMANCE

For many OEMs, SDV strategies look bold on paper. Organizational charts are redrawn, software factories launched, transformation offices staffed. But as CTOs know too well, execution remains the bottleneck. The uncomfortable truth: Most R&D organizations still can't answer the fundamental question, how their operating model is performing. In today's SDV race, R&D performance is no longer a back-office metric; it is a decisive indicator of competitive fitness.

> "OEMs that outperform in R&D don't just move faster. They dominate in cost, quality, and customer value. They build once, scale infinitely, and ship in weeks, not quarters or even years."
>
> Advisory Board Member of a German OEM

Yet, today, too many organizations remain lost in measurement fog. Top executives at legacy OEMs routinely track over 100 KPIs across their development value chain, a well-intended but ultimately self-defeating practice. The result is confusion rather than clarity. Transformation leaders find themselves overwhelmed by data, unable to separate the signal from the noise. The reality is that not all KPIs matter equally. What R&D organizations need is a ruthless focus on the few metrics that truly drive R&D performance: The KPIs that uncover bottlenecks, unlock scale, and expose whether the operating model is actually working. In other words, they need to stop measuring everything and start measuring what matters.

To meet this need, Berylls by AlixPartners, in collaboration with the Institute of Technology Management at the University of St. Gallen, has developed a comprehensive R&D performance assessment model tailored to the SDV reality. Introduced as the **SDV.OM (Operating Model) Framework**, it enables leaders to actively steer and optimize their operating model for software-driven performance. Built on an extensive executive interview series

and real-world benchmarking across global OEMs, the model analyzes execution quality across 18 critical action fields that span the full operating model. The purpose is not to produce another maturity score. It's to give CTOs and transformation leaders a high-resolution view of how well their organization is delivering real software-driven outcomes, and where it is falling short. The model enables three things: A structured assessment of R&D maturity, direct benchmarking against SDV front-runners, and a data-backed transformation roadmap that translates insights into focused, high-impact improvement initiatives. Unlike traditional audit models that evaluate processes in isolation, this model treats R&D performance as an integrated system, where every dimension, from governance and planning to infrastructure, must work in concert.

FIGURE 5:
ACTION FIELDS FOR EACH DIMENSION OF THE R&D OPERATING MODEL

GOVERNANCE	PLANNING	DEVELOPMENT
Decision-making	Innovation management	Engineering approach
Target-setting	Requirements management	Integration & test management
Portfolio management & business case	Product design	Release management & operations

PEOPLE	ORGANIZATION	INFRASTRUCTURE
Talent acquisition	Structural configuration	Data & update management
Talent development	Scalability & adaptability	Tool landscape
Leadership & workforce	Enterprise collaboration	Work infrastructure

To cut through the multitude of available KPIs, the SDV.OM Framework focuses on the key drivers of performance. Drawing on deep interviews with top-level executives, the top three KPIs were identified for each of the 18 most critical action fields; not to discard the rest, but to focus attention where it matters most. The result is a model that cuts through complexity and enables targeted steering. It follows a clear three-step logic: First, the selected KPIs are measured across the organization to capture real performance data; second, these results are normalized and aggregated into action field scores that reflect relative maturity; third, the field scores are rolled up into broader indices for each of the six core operating model dimensions. This structured approach enables executives to benchmark their R&D organization, track transformation progress over time, and prioritize interventions where impact is highest. A deep dive into the development dimension, showcasing how KPI consolidation reveals real performance levers, follows in the next chapter.

Having outlined the assessment logic, we now move from structure to insight, beginning with the **Governance** dimension as a crucial starting point for diagnosing R&D performance. In this dimension the assessment model focuses on three critical action fields: Decision-making, target-setting, and portfolio management & business case. For instance, traditional OEMs often operate with up to 13 management layers, slowing decisions and diffusing accountability. In contrast, SDV front-runners cut down to just 3-4 layers, enabling real-time steering and faster development cycles. KPIs such as "decision hierarchy depth" and "time-to-decision" are no longer optional, but essential markers of a modern, execution-ready R&D setup.

In the **Planning** dimension of an operating model, performance measurement is critical because planning defines the trajectory of every development initiative, and in the SDV model that trajectory must be fast, flexible, and value-driven. For instance, traditional OEMs often built exhaustive requirement catalogs before development began, locking down thousands of specifications to align with suppliers. While well-intentioned, this over-specification delays innovation, reduces adaptability, and creates unnecessary rigidity. In contrast, SDV leaders adopt an agile, life cycle-based planning approach: They define only core requirements early on and leave space for iterative refinement. This shift accelerates time-to-market and enables richer, more customer-focused features. Going beyond this example, the model assesses maturity in this dimension along three key action fields: Innovation management, requirements management, and product design. KPIs such as the "total number of requirements" provide direct insight into an OEM's ability to plan for speed, flexibility, and long-term value creation.

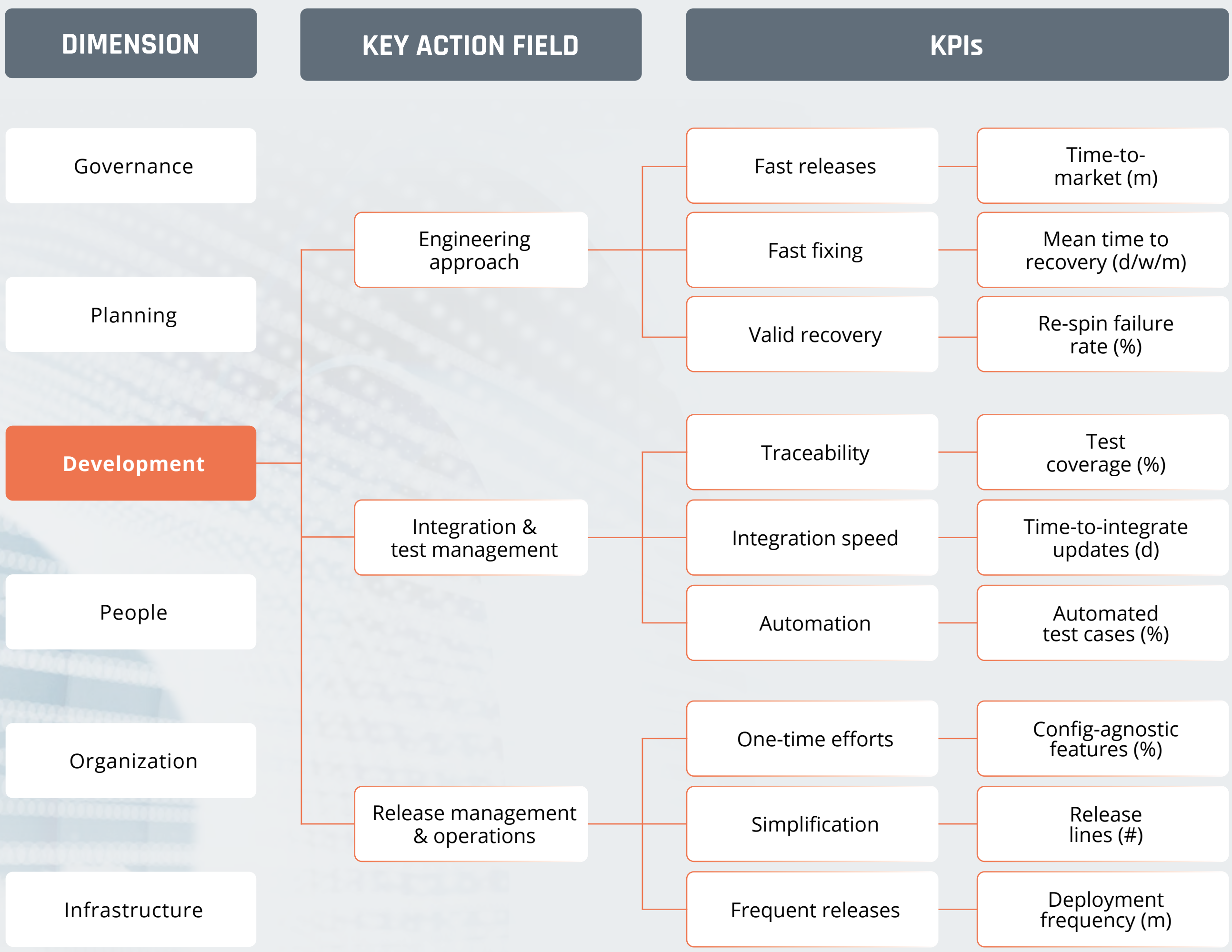
The **Development** dimension has become the make-or-break lever of R&D competitiveness. For example, traditional setups often take 9 to 12 months from defining a requirement to releasing a feature, timelines that are fundamentally incompatible with SDV market dynamics. In contrast, digital-native players operate with a different cadence: Software is delivered in weeks, sometimes days. Their edge lies not just in culture, but in engineering fundamentals, including monorepositories, integrated toolchains, and full DevOps automation. These enablers allow continuous testing, seamless deployment, and rapid iteration. Measuring performance in this space is critical because it directly reflects an OEM's ability to scale execution and respond to customer needs in real time. The SDV.OM Framework focuses on three action fields: Engineering approach, integration & test management, and release management & operations. KPIs such as "time-to-market" serve as sharp diagnostics of execution maturity and agile delivery capability.

As SDV maturity increases, the **People** dimension becomes a growing determinant of transformation success – or failure. The core question is no longer how many people an OEM employs, but what kind of people, and whether they are empowered to develop software-enabled features. Many legacy R&D functions are still dominated by coordinators and managers. To lead in software, OEMs must build organizations led by technologists, not administrators. That means attracting top software talent, continuously developing critical skills, and ensuring leadership actually understands what is being built. The SDV.OM Framework therefore measures performance across three action fields: Talent acquisition, talent development, and leadership & workforce. An exemplary standout metric is the "leadership-tech-ratio" which quantifies the proportion of R&D leaders with dedicated software development capabilities; a direct indicator of whether the organization is equipped to steer a software-first future. Without measurable capability uplift, transformation will remain stuck in presentation mode, never reaching the product.

The **Organization** dimension focuses on the structural and collaborative capacity of the R&D organization. For example, in legacy setups, rigid silos and domain-based departments reflect a world of sequential vehicle programs and waterfall development. In the SDV era, this model breaks down. Winning OEMs are shifting toward flatter, cross-functional teams that align around customer value, not legacy structures. The ability to scale agile teams and enable dynamic collaboration has become a critical competitive advantage. Measuring performance here helps reveal whether the organization is structured to innovate, or stuck in a product cycle mindset. The three action fields in this dimension are structural configuration, scalability & adaptability, and enterprise collaboration. For instance, a telling KPI is "cross-functional team adoption," which tracks the share of teams operating in agile, multidisciplinary models. This metric helps executives understand whether innovation is distributed and scalable, or still gated by silos and steering cascades.

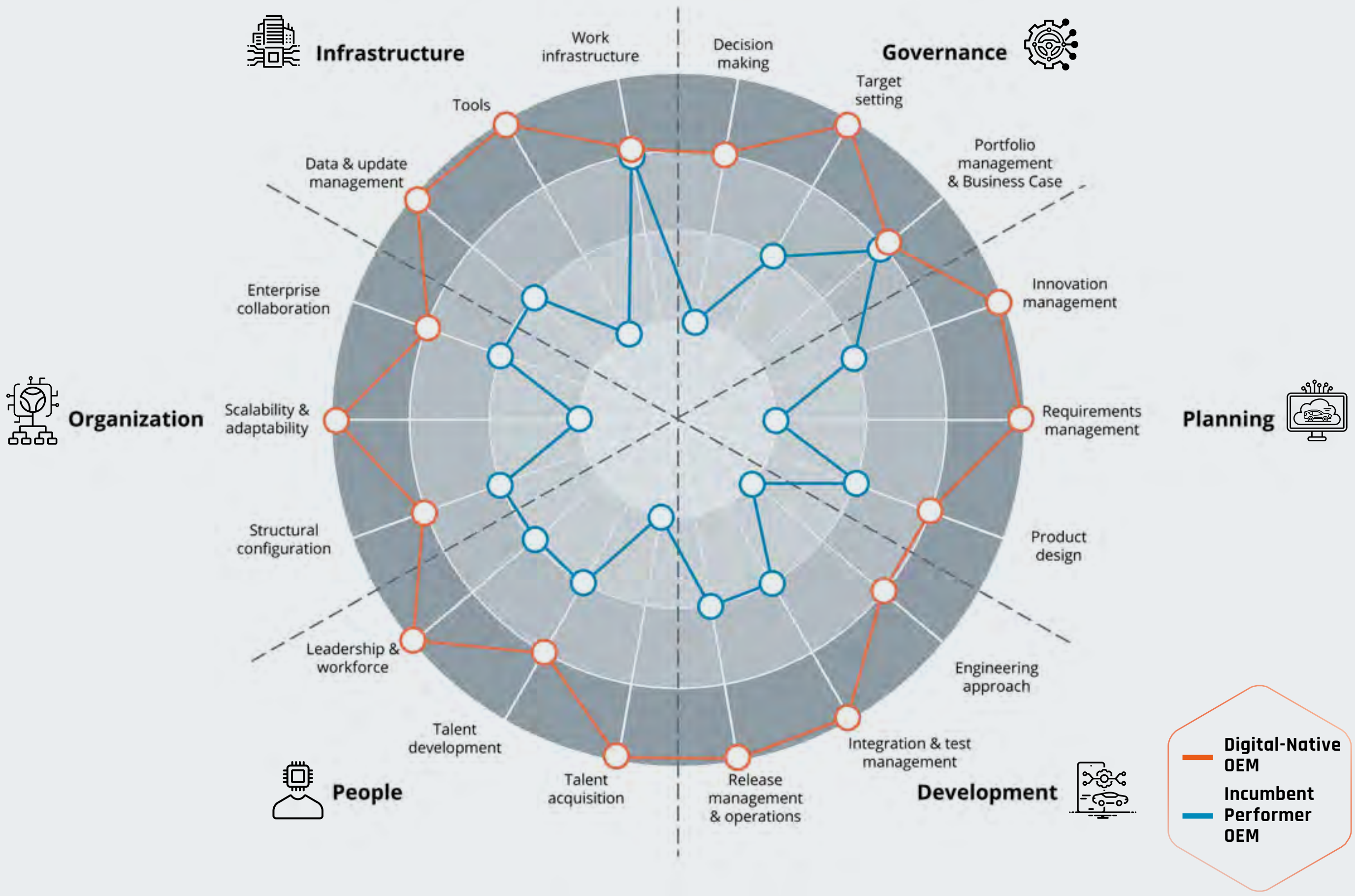
Lastly, the **Infrastructure** dimension determines whether the organization's technical backbone enables, or obstructs, software excellence. Too often, legacy OEMs operate with fragmented toolchains, whereby basic development tasks span dozens of disconnected systems. This leads to slow cycles, redundant work, and hidden costs. By contrast, leading SDV players are building integrated, automated software factories with seamless toolchains and unified data access. Their goal is simple: Move from friction to flow. Measuring this shift is essential, as infrastructure maturity is a prerequisite for quality, speed, and traceability. The assessment model focuses on three action fields: Data & update management, engineering tools, and workforce infrastructure. For instance, a critical KPI is the "tool redundancy ratio," which quantifies how many tools serve overlapping functions, a clear signal of integration gaps and productivity drag. The more streamlined the toolchain, the faster an organization can ship, iterate, and scale.

FIGURE 6:
ASSESSMENT OF EACH DIMENSION IS BASED ON INDUSTRY PROVEN KPIs



THE PRODUCT DEVELOPMENT PERFORMANCE REVIEW

FIGURE 7:
R&D PERFORMANCE BENCHMARK COMPARING TRADITIONAL AND DIGITAL-NATIVE OEMs



This chapter offers a focused deep dive into one dimension of the SDV.OM Framework, i.e. the development processes, the core execution engine where SDV strategies either accelerate or stall. For CTOs, this is where software ambition must translate into scalable, high-quality delivery. As vehicles become software-defined, legacy processes must evolve into agile, automated, and continuously integrated systems. The purpose of this chapter is to demonstrate how the SDV.OM Framework evaluates performance in this critical dimension, using concrete KPIs across three action fields: Engineering approach, integration & test management, and release management & operations.

In the action field **Engineering Approach,** the assessment focuses on how effectively OEMs adopt software-driven development principles within their R&D organization. While most managers recognize the need to decouple hardware and software cycles, legacy OEMs often struggle to implement this in practice due to rigid validation and release procedures. In contrast, digital-native players follow a “minimum viable product" (MVP) approach, launching features before they are fully market-ready to enable real-world learning and rapid iteration. To benchmark this shift, the SDV.OM Framework evaluates three key KPIs: Time-to-market (months), mean time to recovery (days), and change failure rate (%).

These metrics reveal the speed, responsiveness, and software release quality of an R&D organization. For example, top-quartile SDV players achieve time-to-market lead times of under one month for new features, while many legacy OEMs still exceed six months due to tightly coupled linear processes. On the topic of bug resolution, digital-native OEMs routinely resolve noncritical issues within a single day, whereas traditional players often need eight weeks or more. Lastly, the change failure rate exposes release quality: while industry leaders maintain error rates below 5%, others suffer from over 20% of updates requiring post-release patches to fix customer-critical functions.

In the action field **Integration & Test Management,** the assessment evaluates how OEMs manage the increasingly complex demands of validating continuously evolving SDV software. Unlike traditional vehicles, where testing occurred late and mostly offline, SDVs require constant integration and real-time validation across multiple environments. This shift demands comprehensive traceability and coordinated testing across unit, system, and vehicle levels. Leading OEMs now adopt "shift left" strategies, testing earlier to catch issues sooner and reduce downstream reworking. The SDV.OM Framework captures performance in this field through three strategic KPIs: Test coverage (%), time to integrate update (days), and automated test cases (%).

These KPIs reflect how traceable, fast, and automated a development process truly is. For instance, code coverage reveals how much of the software is actually tested; high performers such as Rivian exceed 95%, while laggards test less than 20%, often relying on manual validation late in the cycle. "Time to integrate update" measures how quickly virtual hardware-in-the-loop (vHiL) systems can accept new builds; digital leaders manage this in under 24 hours, whereas traditional OEMs may take up to six months. Finally, test automation is essential for continuous deployment. Tesla, for example, achieves over 95% automation by leveraging a unified codebase and test framework, while legacy players often automate less than 10% of cases, resulting in slower cycles and higher defect rates.

In the action field **Release Management & Operations,** the assessment focuses on how effectively OEMs deliver tested software into vehicles and manage its life cycle during real-world operation. As SDVs evolve continuously, the release process must shift from rigid, milestone-based cycles to flexible, frequent deployments. Digital-native OEMs embrace an MVP mindset, releasing features once core requirements are met, without waiting for every corner case to be resolved. This enables faster learning, faster iteration, and higher responsiveness to user needs. The SDV.OM Framework evaluates maturity in this field using three KPIs: Configuration-agnostic feature ratio (%), number of release lines (#), and deployment frequency (days).

These KPIs highlight how OEMs can simplify complexity and industrialize software delivery. The configuration-agnostic feature ratio reflects how many features are developed once and reused across platforms without major reworking. Leading players achieve over 90%, while traditional OEMs remain below 10% due to fragmented architectures. The number of release lines reveals the complexity of software operations. As a result, leading OEMs maintain a single, unified line for all vehicle platforms and even legacy models, whereas large legacy OEMs often juggle more than five. Finally, deployment frequency is a direct proxy for operational agility. Agile OEMs push updates weekly, offering new features or fixes in real time, while laggards release software every three to six months, often constrained by validation bottlenecks and fragmented release strategies.

This deep dive into the Development dimension reveals: High-performing OEMs treat speed, integration, and release as strategic disciplines, not technical afterthoughts. Measurable excellence in engineering, testing, and operations is what separates software-first leaders from legacy laggards.

FIGURE 8:
COMPARATIVE R&D PERFORMANCE IN DEVELOPMENT PROCESS CONTEXT

KEY ACTION FIELD	KPIs	SPECIFICATION	REFERENCE VALUES: Weak	Moderate	Strong	Very Strong
Engineering approach	Time-to-market (m)	Average time from requirement def. to 1st release of a new non-homologation-relevant feature [1].	> 6 m	3-6 m	1-3 m	< 1 m
Engineering approach	Mean time to recovery (d/w/m)	Average time from failure identification to implementation of an interim corrective action.	> 2 m	1 w-2 m	1-7 d	1 d
Engineering approach	Re-spin failure rate (%)	Ratio of releases that require fixes for failures that are classified as customer critical.	> 10 %	5-10 %	1-5 %	< 1 %
Integration & test management	Test coverage (%)	Ratio between lines of code for which a test was run versus overall lines of code.	< 50 %	50-70 %	70-95 %	> 95 %
Integration & test management	Time-to-integrate updates (d)	Average time to integrate an update up to V-HiL; for complex, distributed, network relevant functions [2].	> 6 w	2-6 w	3 d-2 w	< 3 d
Integration & test management	Automated test cases (%)	Ratio of test cases executed automatically versus test cases executed manually.	< 50 %	50-80 %	80-95 %	> 95 %
Release management & operations	Config.-agnostic features (%)	Ratio of features that are independent from vehicle configurations and platforms versus overall number of features.	< 40 %	40-70 %	70-90 %	> 90 %
Release management & operations	Release lines (#)	Number of release lines for vehicles/ platforms in development and in production.	> 4	3-4	2-3	< 2
Release management & operations	Deployment frequency (m)	Average time between new software versions for feature updates released in full compound.	> 6 m	3-6 m	1-3 m	< 1 m

Digital-Native OEM | Incumbent Performer OEM

1 Medium complexity, e.g. Lane Departure Warning
2 e.g. rear-view camera (FMVSS compliant)

CONCLUSION

The automotive industry is in the midst of a historic transformation, as the product and its architecture continue to change rapidly. New digital-native players, especially from China, are redefining the pace of innovation, software velocity, and cost efficiency. Weekly over-the-air updates, fully integrated toolchains, and agile delivery structures have moved from aspiration to standard. For legacy OEMs, this shift has exposed a growing execution gap.

Most industry leaders have already recognized the strategic importance of aligning their R&D operating model with their SDV product strategy. The challenge, however, is not vision, it's execution. Despite organizational charts being redrawn and digital hubs being launched, many transformations remain stuck in planning mode. Numerous studies offer conceptual blueprints, but few provide structured pathways to operationalize performance.

This is where the SDV.OM Framework for the assessment of R&D performance developed by Berylls by AlixPartners and the Institute of Technology Management at the University of St. Gallen delivers value. It offers a comprehensive, practical toolset for CTOs and R&D executives to move beyond strategic intent and into measurable action. Specifically, the model enables leaders to:

- **1 | Quantify R&D Performance Across All Core Operating Model Levers:** Establish a clear, data-backed baseline of how well your operating model performs and benchmarks against SDV front-runners.
- **2 | Translate Insight into Focused Action for Competitive Advantage:** Convert diagnostic insights into focused, actionable measures that boost execution speed, engineering efficiency, and SDV readiness – cutting through legacy inertia.

This dual-purpose design, enabling performance diagnostics with transformation guidance, positions the model as more than an assessment tool. It becomes a continuous steering system for software-driven execution.

CTOs who succeed in this transition will be those who treat performance not as a report, but as a management discipline. The automotive future won't be decided by who plans best, but by who builds, iterates, and scales fastest – with discipline, traceability, and measurable impact. The time to act is now: unlock the full potential of your R&D engine and turn strategy into a sustained, software-driven advantage.

WHAT'S NEXT?
THE CTO PLAYBOOK

PREPARE

1. **Engage Key Decision Makers Early**
Involve product, finance, and tech leads to ensure buy-in, shared objectives, and access to critical performance data.

2. **Collect and Validate Performance Data**
Capture the right KPIs across the six operating model dimensions, while prioritizing facts over perceptions.

ANALYZE

3. **Benchmark and Identify Performance Gaps**
Compare your organization against SDV leaders and pinpoint execution bottlenecks and missed efficiency levers.

TRANSFORM

4. **Translate Gaps into Targeted Measures**
Prioritize high-impact improvement areas, define clear ownership, and align with product strategy and budget.

5. **Build a Continuous Transformation Engine**
Institutionalize SDV.OM-based assessment as a recurring practice to drive ongoing performance reviews, adaptations, and roadmap steering.

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