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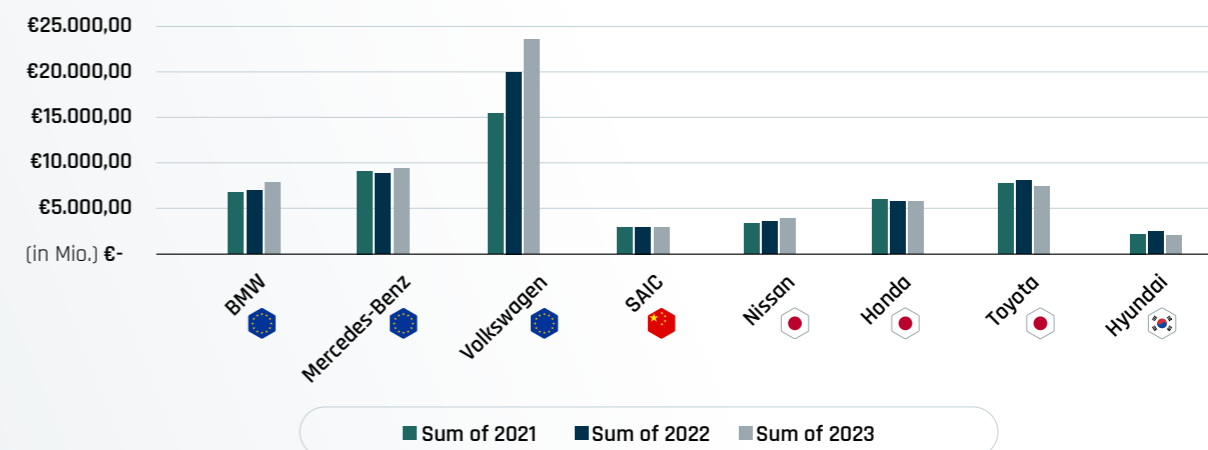
# ATTENTION CTO: R&D needs a different type of efficiency program

Falling vehicle sales, with a drop of up to 18 percent in August 2024 alone as displayed in Figure 1, is just one sign of the growing urgency for change facing OEMs in Europe. Rising costs, shrinking margins, and the transition to electric vehicles (EVs) are significant challenges that also require immediate attention. And increasingly, these economic factors are deeply tied to the responsibilities of the Chief Technology Officer (CTO).

	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24
<b>BEV</b>	-16,9	28,9	9,0	-11,3	14,8	-12,0	-1,0	-10,8	-43,9	9,8	2,4
<b>Total</b>	-3,3	12,1	10,1	-5,2	13,7	-3,0	4,3	0,2	-18,3	-6,1	1,1

**Figure 1**  
Monthly year-on-year difference in car sales european union (%) (acea)

This is because OEMs and suppliers have invested heavily in new technologies and capabilities in recent years, from developing new E/E architectures for software defined vehicles, building up in-house expertise and acquiring companies to add new capabilities, and developing battery know-how and production facilities. All of this work has increased overhead costs per vehicle (figure 2), as OEMs push to recover their EV investments quickly.



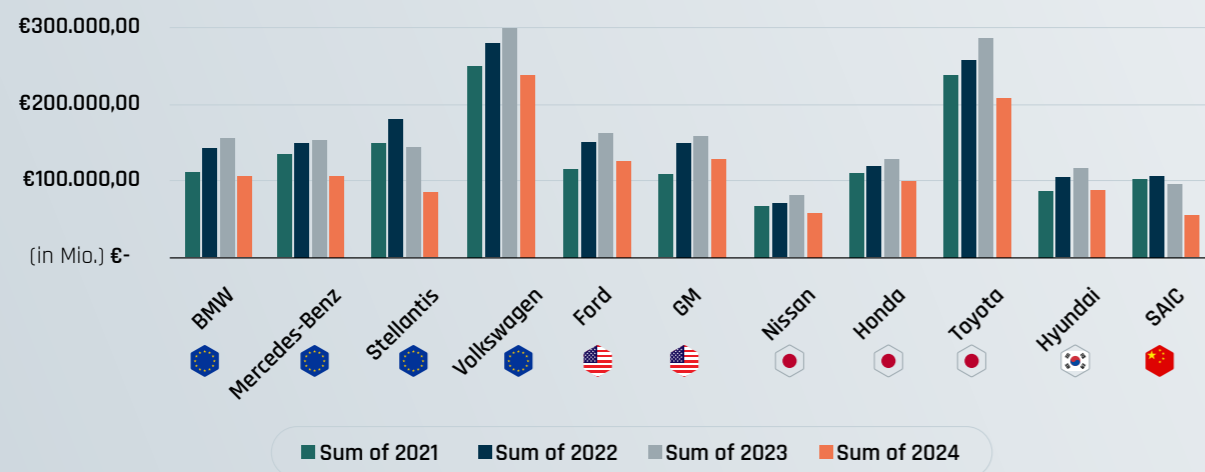
**Figure 2**  
R&D spend selected european oems (bloomberg)

But at the same time, revenues have dropped across the market in 2024, in contrast to the past three years as Figure 3 shows. EV sales in Europe are struggling even more than those of conventional cars – lower subsidies have made EVs more expensive to buy, while weak demand in used car markets means falling residual values, driving up the total cost of ownership<sup>2</sup>. The battery electric vehicle (BEV) models on offer, such as Volkswagen’s ID.3, are yet to meet customer expectations in terms of range, price and functionality, and lag behind competitors - including cheaper Chinese car brands that are new to the European market.

<sup>1</sup><https://www.reuters.com/business/autos-transportation/eu-car-sales-3-year-low-august-ev-sales-down-439-acea-says-2024-09-19/>

<sup>2</sup> <https://www.adac.de/news/e-monitoring/>

Supply chains add a further layer of disruption, especially for batteries, because of the growing reliance on Asian suppliers due to limited European battery capabilities and production capacity<sup>3</sup>. New regulations including Germany's Supply Chain Act (LKSG) and CSRD demand more transparency along the value chain, and some target markets, such as the US, restrict sourcing from certain regions (for example the Uyghur Forced Labor Prevention Act covering goods made in the Xinjiang region of China). In the years ahead, OEMs face significant challenges complying with these regulations, while also integrating new technologies into their long-established supply chains and making decisions on which alternative locations offer the best options for buying or building the technologies of the future.



**Figure 3**  
Revenue of selected OEMs (Bloomberg)



**OEMs and suppliers must invest heavily in new technologies and capabilities. These investments will further strain the cash flow situation as sales decline but remain essential for future competitiveness.**

<sup>3</sup> VDMA, Roadmap Batterie-Produktionsmittel 2030, S.20, S.32

## No time to lose

With all these factors in mind, and the decline in sales this year, European OEMs' production facilities are operating well below capacity. The resulting cash flow crisis needs immediate and robust efficiency programs to avert severe financial distress<sup>4</sup>.

In response, many OEMs are launching programs designed to streamline operations and enhance productivity. These initiatives are crucial for maintaining competitiveness and ensuring their long-term sustainability in a rapidly transforming market. However, becoming more cost-effective will not be enough on its own. As described above, some of the most significant challenges have their roots in vehicle development and will require specific changes led by the CTO. The technology stack and product structure need to be evaluated and updated to meet the challenges of a new era, clearing away legacy ways of working.

However, a 'copy-paste' approach of taking methods used successfully in China and applying them in Europe will not work. To succeed, efficiency programs for R&D must follow a holistic approach which covers product, processes, organization and partners. All contributors must be committed to the goal of change, and the efficiency model must be set up in a way that anchors it for the long term. Below, we set out five key levers to improve efficiency in vehicle development, and how to approach implementing them.

## Five levers to pull

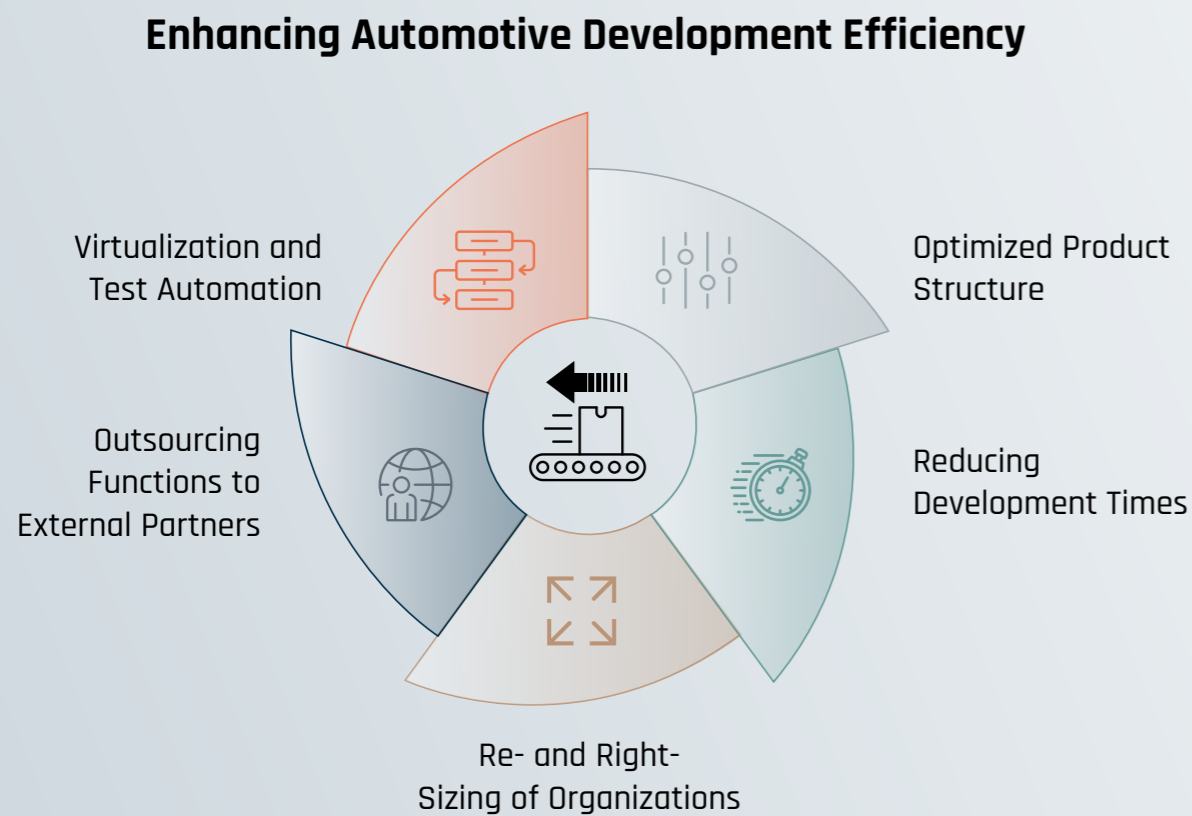
Companies start efficiency programs to increase profits while reducing costs, with the aim of maximizing output and minimizing input by enhancing productivity with fewer resources. This can be achieved by streamlining processes and refining the way manufacturing is organized to optimize the operating model. Usually, a dedicated project team is established to define and report on progress on various work packages for the management team, until set targets are reached.

However, to become leaner and more cost-efficient in R&D, the OEM's technology strategy (tech stack), product life cycles and the development environment must all be considered. A 360° approach within R&D means not only an improved operating model but also a streamlined product portfolio based on a concise technology strategy, a well-defined set of core competencies resulting in a partnering model with a capable supplier base, and a more data-driven and connected working environment that reduces development time to a minimum.

For CTOs, the huge challenge is to keep efficiency programs aligned with current market dynamics and advances in technology. A static program will not work - continuous adaptation through iterative processes is key to ensure changes in technology and customer demands are not left behind.

<sup>4</sup> Gerster et al, 2024, "Exklusive Analyse: So sind Deutschlands Autowerke ausgelastet", in: Automobilwoche, 15.07.2024

To keep pace with market demands and optimize resource use, the following five strategic levers can be applied to drive efficiency gains. Together, they create a streamlined, adaptable and future-ready development process:



**Figure 5**  
Levers in R&D Efficiency (own illustration)



## 1. Optimizing the product structure

Efficiency in R&D begins with the product structure. Being able to offer differentiated product lines and features may dominate the thinking of customer service and sales departments, but R&D teams need to think in terms of synergies, efficiencies and commonality between technical features. To reduce costs, the CTO's role is to oversee the various product lines within the organization and consolidate all of these in the most efficient way, within the overarching architecture used by the OEM. In terms of efficiency, it means products need to be consolidated so they fit under one, or a very small number of, umbrellas to thrive in future.

For some OEMs this may sound like old news, as they've been using modules and toolkits for decades. The difference is that an overarching architecture includes functional and systemic components at a vehicle level, and is managed thoroughly with no deviations, no breaches of the rules, and no extras increasing cost and reducing standardization. OEMs including NIO and XPeng in China, as well as Audi in Germany, have already begun to think of E/E 'generations' rather than product line specifications. To gain the benefits of this change, however, skills and the organizational structure need to be adapted.



## 2. Reducing development times

Shorter development cycles are a top priority for automotive companies, to speed up time-to-market and reduce cost. Companies such as NIO have development cycles of two to three years, compared with traditional OEMs, where development takes four to five years, and in some cases up to seven. This is because new EV makers like NIO have a stronger focus on software and agile development processes, which allow for rapid iterations. Combined with capabilities such as “over-the-air” software updates, enhancements without physical changes to the vehicle can be made much more quickly, even late on in the development process.

These kinds of measures break down large projects into smaller, parallel workflows which shorten development cycles considerably. Agile practices and iterative development cycles, like those used in software development projects, also have faster feedback loops, which reduce the need for costly late-stage rework.

Cross-functional collaboration is another part of reducing development time. Tesla, for example, is well-known for aligning its engineering and production teams early on, reducing handover delays and improving responsiveness to market changes. This practice has been key to its speed in bringing new models to market.



## 3. Re- and right-sizing organizations

Adapting the organizational structure to changing technological and market demands is essential to making automotive development more efficient. Right-sizing involves tailoring team composition, skill-sets and roles to match project demands in alignment with target processes, often by restructuring and eliminating redundant roles. When paired with a systems engineering approach, this lever consolidates areas of responsibility while streamlining staffing needs within projects and departments.

Using a systems engineering approach means the technological definition and breakdown of the product is what shapes the engineers’ responsibility, rather than which part of the organization is assigned to create it. The resulting product structure, with its hardware, software and functional requirements, should be used when teams and projects are defined, to make sure that the most up-to-date technological possibilities are exploited and do not fail because the organizational structure is not set up to be able to incorporate them..

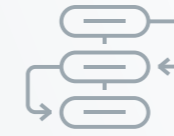
Ford’s recent restructuring efforts, which included significant workforce reductions in Europe, were aimed at creating leaner, more efficient teams focused on high-priority tasks such as EV development. Similar changes by companies including Stellantis emphasize cross-functional collaboration and flexibility, enabling leaner teams to work on the highest-impact projects. A right-sized organization facilitates faster decision-making and better communication, both of which are crucial for efficient development processes.



## 4. Outsourcing to external partners

Outsourcing specific functions to external partners allows OEMs to leverage specialist expertise without overstressing internal resources, or to access skills they do not have in-house. Functions like software coding and testing can often be effectively outsourced to trusted partners. Doing so reduces the internal workload, allowing core teams to focus on strategic and innovative tasks, while external partners handle standardized or resource-intensive operations.

In terms of future capabilities, OEMs also need to think about partnering rather than outsourcing to make the most of existing technologies and capabilities on the market. For example, platforms that function as middleware, linking different applications, can be developed in-house, but using time and resources to do so is less competitive than forming a partnership with a specialist. By building a robust network of external collaborators, CTOs can allocate resources and scale development capabilities as needed, improving efficiency and cost-effectiveness for the long term.



## 5. Virtualization and test automation

The complexity of modern automotive systems makes virtualization and test automation indispensable tools for efficiency. Virtual testing environments allow companies to simulate a range of conditions without the need for physical prototypes. For instance, Audi uses virtual simulations extensively to test new vehicle designs, which has significantly reduced the need for physical prototypes and the associated cost<sup>5</sup>. Virtual testing can be extended to include crash tests and lifecycle tests for hardware as well as software, to create greater efficiencies.

Within software development, OEMs can also use continuous integration and continuous deployment (CI/CD) chains. These facilitate the automation of testing and deployment, reducing the cost of testing and accelerating delivery to product teams.

These five strategic levers, when implemented together, can drive significant improvements in efficiency, creating a more agile, responsive, and cost-effective development process.

<sup>5</sup> Simulate to fabricate: vehicle plants keep VR and AR in their sights | Article | Automotive Manufacturing Solutions

# Efficiency programs done right: Finding the gaps and closing them

At the start of an R&D efficiency program, there are two approaches to target setting – top-down and bottom-up. Our experience working with OEMs shows combining the two ensures a balance between strategic ambition and operational feasibility. A top-down target motivates the organization with a clear vision, while bottom-up analysis ensures realistic goals for execution, leveraging technical expertise and driving innovation across the value chain. The two approaches are carried out in the following way:

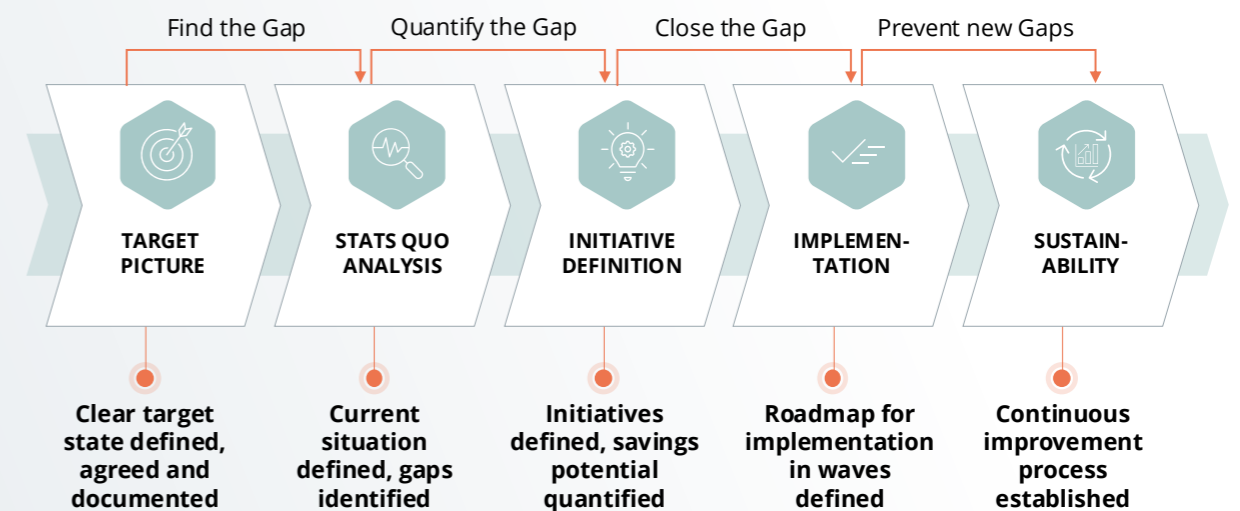
## Top-Down:

This method starts with a clear, ambitious goal set by leadership, such as achieving 20% cost savings within three years. From the CTO's perspective, this target aligns with strategic objectives such as market competitiveness or long-term profitability. Teams then break down the overarching target into departmental or functional goals, ensuring alignment with the company's vision. This approach emphasizes urgency and a unified direction, fostering accountability across the organization.

## Bottom-Down:

In this method, the focus is on analyzing individual processes, workflows, and inefficiencies at the operational level to identify potential improvements. Engineers, managers and teams collaboratively evaluate opportunities for savings, such as reducing material waste, optimizing production lines, or improving energy efficiency. The aggregated savings from these improvements define the overall target, emphasizing practicality and granular optimization.

For the project set-up and work package definition, target pictures are defined top-down, while the specification of clear goals and activities follows in the status quo analysis and initiative definition of work packages (see chart below). During the implementation and continuous improvement stages, defined targets need to be followed up operationally (bottom-up).



**Figure 6**  
Approach to R&D Efficiency Programs (own illustration)

## 1 Defining a target picture

The first stage of the program is to define a clear target picture – an ideal state of technological and operational efficiency that aligns with the company’s strategic objectives. The target includes specific goals in areas such as reduced development times, improved resource use, and overall cost reduction. As a directional baseline for the upcoming process of change, the target picture is precisely documented and committed to by all key stakeholders.

## 2 Status-quo analysis

Once the target picture is defined and agreed upon, a comprehensive assessment of the current state follows. This includes analyzing existing systems, workflows, and resource use across the technology stack. By gathering key metrics on areas such as system uptime, software efficiency and resource allocation, the organization can identify bottlenecks and inefficiencies. Techniques such as process mapping and benchmarking against industry standards may be employed here to create a clear, data-backed picture of the current operating model. A gap analysis is conducted to determine the difference between the current and target states. By identifying gaps in efficiency and productivity, the CTO can pinpoint key areas for improvement and set realistic goals to achieve the target picture.

## 3 Initiative definition and cost-saving potential analysis

Following the gap analysis, the next phase is to develop initiatives aimed at bridging the identified gaps. Each initiative is assessed based on several factors: potential cost savings, resource requirements, implementation time, and expected impact on operational efficiency. Initiatives may range from adopting new software to restructuring teams or automating key functions. The cost-saving potential of each initiative is evaluated through detailed financial modeling to ensure a clear understanding of both immediate and long-term savings. Assessing initiatives in this way allows the CTO to prioritize based on feasibility and return on investment (ROI), ensuring that resources are directed toward the most impactful projects.

## 4 Roadmap and phased implementation analysis

With initiatives defined, the CTO must create a structured roadmap to guide the program’s implementation. Typically, this roadmap is phased into multiple waves to spread resource use over time and allow iterative learning and adjustment. Each wave includes a set of prioritized initiatives, with short-term, high-impact projects often addressed first to build momentum. A phased approach also enables the organization to track progress incrementally, adjusting resources and timelines as needed to optimize implementation.

# 5

## Defining a target picture

For an efficiency program to deliver lasting value, it must be sustainable. This final phase involves setting up systems for continuous monitoring and improvement, ensuring that efficiency gains are preserved over time. Regular metrics reviews, iterative audits, and adjustments in response to emerging technologies or changing operational needs help maintain alignment with the target picture. Additionally, empowering line functions with the tools, training, and authority to drive ongoing improvements creates a culture of efficiency and accountability within the R&D organization. This enables teams to autonomously identify and address inefficiencies as part of their daily workflows, contributing to a sustainable, long-term shift in operational effectiveness.

Faced with falling sales, squeezed margins and increased competition, the need for efficiency programs is urgent. To ensure OEMs can stay competitive for the long-term, holistic change is needed in vehicle development, and for CTOs, the five levers— optimizing the product structure, reducing development time, re- and right-sizing the organization, outsourcing functions to external partners, and virtualization and test automation—are the key actions that will enhance development efficiency. They will enable the R&D organization to align its operational activities with the broader technological goals, driving long-term success.

The comprehensive approach to establishing efficiency programs we describe here will empower teams to identify and address inefficiencies, based on a future-oriented technology roadmap, cooperating across functions to build the most advanced products.



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