**SIEMENS**
*Ingenuity for life*

# Accelerate innovation to unleash the next generation of vehicles

## Siemens Accelerated Product Development

The automobile industry has traditionally designed cars across separate teams, using different tools for design, testing and manufacturing. This has been suitable for decades. However, the automotive landscape has changed dramatically during the last few years. Today, automakers are facing intensified competition from more technology-driven market players, rapidly changing consumer demands requiring more personalized and sustainable products and increased regulatory requirements. New engineering processes will be required to deal with this increasingly complex environment, enabling a faster, more cost effective and efficient pace of innovation. Without the ability to embrace this complexity, carmakers will jeopardize their position in the automotive landscape.

New engineering processes will be required to deal with an increasingly complex environment.

# Exploring many paths to innovation

Carmakers have gradually evolved the research and development (R&D) processes required to successfully bring new vehicles to market. These processes involve several sequential steps for designing the components and software across separate teams and then integrating them at the end.

These original equipment manufacturers (OEMs) have also grown economies of scope and scale by investing in fixed manufacturing facilities, developing repetitive processes and improving the training of specific types of skills. However, there is a recognition these practices can sometimes slow the pace of innovation. For example, a designer generating computer-aided design (CAD) models will need to wait a few weeks for a computer-aided engineering (CAE) analysis. With the growing complexity of vehicle platforms, this is even more true. The desire to accelerate the product development process in some way must contend with a fear that transitioning to something different will require significant organizational change and will be costly and time-consuming.

Another concern relates to managing engineering and project data, including regulatory requirements. Teams are used to working with tools for different individual tasks and have cobbled together workflows that everyone knows and understands. Many of these tools are ingrained in the engineering process, which makes it difficult to change them to something that could potentially work better. There is also a concern that a new tool may be difficult to use or implement, which makes carmakers reluctant to opt for new solutions.

## Growing sources of complexity

Although most executives recognize the traditional development approach cannot keep pace with changing customer and industry needs, there is not a broad consensus on how to execute on this. Simply hiring more resources to expedite product development can lead to more manual handoffs, which can slow things down. Alternatively, finding ways to remove or bypass critical steps in development such as testing and reviews can result in problems late in product development, which increases overall costs and causes additional delays. Carmakers failing to adopt new development approaches will face continuous difficulties, causing products to be antiquated or not relevant when finally released, potentially resulting in loss of market share and revenue.

Carmakers also need to adapt to increased and dynamic regulatory, sustainability and homologation requirements driven by climate change and new technologies such as vehicle electrification, advanced driver assistance systems (ADAS), autonomous vehicles and corporate average fuel economy (CAFE) improvements. As a result, they need to hire more legal services to manage the growing complexity of vehicle audit trails. Regulatory missteps could lead to consequences impacting the profit and reputation of the business.



Carmakers have to deal with increased and dynamic requirements driven by climate change and new technologies.

McKinsey predicts there will be a tripling of complexity in the next 10 years. As OEMs and suppliers will have difficulty dealing with this complexity because their productivity is not increasing at the rate needed to sustain innovation, the return-on-investment (ROI) from new technical innovation is far off in the future. As such, companies still must develop traditional vehicles to make revenue now. This balancing act is complicated by the cost of experimenting with new designs in engineering, on the production floor and the shop floor. Not being able to successfully deal with this challenge will lead to late problems in the product lifecycle and can adversely affect the ROI of new products.

More complex vehicle and component designs also involve more integration points between mechanical, electrical and software systems. As these integration points are traditionally not connected, they represent opportunities for new problems to emerge. The traditional engineering approach to innovation also does not allow companies to maintain the same level of quality with these more complex designs, which can result in increased warranty claims and recalls. Warranty Week observed a recent uptick in warranty claims for small vehicles to the highest claims rate since 2009.

OEMs are also struggling with integrating the software required to run on these new designs. McKinsey estimates that 30 to 50 percent of the software efforts now focus on integration. Changes to any one module now requires extensive rework.

### Better coordination required

Striking the new balance between a faster pace of innovation while maintaining profits will require a different approach to coordinating the flow of engineering, requirements, production and testing data across disciplines. To embrace this increasingly complex environment, teams need to implement an accelerated product development approach to improve collaboration across disciplines. They can support this transition using software tools to synchronize data across development, testing and production teams, which will lead to more efficiency and help balance speed and cost.
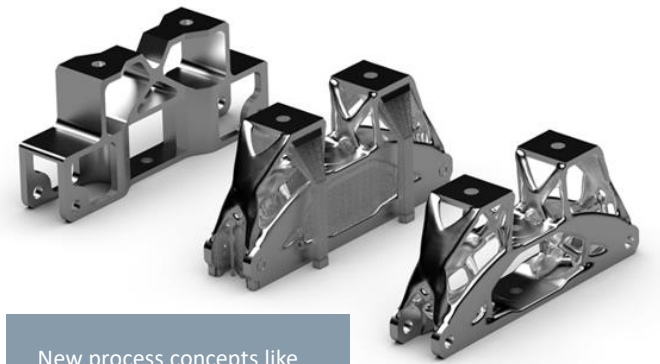
New process concepts like generative design can be leveraged to identify innovative designs.
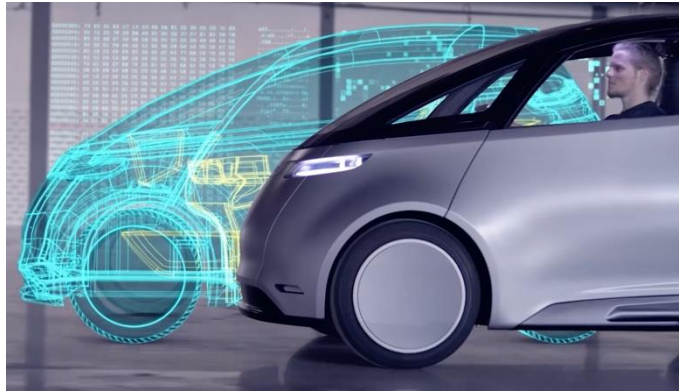
### Keep the showroom fresh

A comprehensive digital twin and thread helps automakers adopt a highly efficient product development process that helps to reduce waste, delays and failures. It leverages new technologies that expedite R&D. This enables companies to innovate and develop products faster and more efficiently, which keeps the showroom fresh with frequent model introductions. Simultaneously, high levels of quality can be maintained, reducing design problems and keeping warranty costs under control. These new designs not only look better but can take advantage of the latest innovations in technology. An integrated digital thread allows for the synchronization of up-to-date information throughout the product development ecosystem.

### First time right in less time

Once the basic foundation for testing earlier in development is in place, teams can also begin to automate design with new process concepts like generative design to identify innovative designs, which can be automatically tested against the digital twin. A comprehensive digital twin also enables sophisticated virtual validation methodologies to drive down the number of physical prototype builds and tests. This eliminates the design-build-test-fail cycle that has plagued the industry with delays, cost overruns and recalls. The new focus of such an accelerated product development process is first time right!

### More gets done with less resources

Easy-to-use, automated, fast and accurate simulation technologies provide people in more engineering roles with access to tools for improving all aspects of the product development process, ensuring targets are met virtually and success is achieved the first time. These highly integrated product development technologies can help automate engineering workflows to reduce time and costs by eliminating wasted time and resources. Simulation can also shift left many traditional downstream activities like cost management and manufacturing validation, allowing you to identify problems earlier in the process when they are cheaper and easier to address. This reduction in wasted time frees up resources to address innovation efforts.

**Improve regulatory compliance**

Companies can also automate the generation of an audit trail by implementing an integrated product data management system. This is critical for exploring more complex designs without having to hire a new team of lawyers to manage the associated paperwork. It can provide anyone in the ecosystems with instant access to all product data including regulatory or sustainability requirements, test results, simulations and changes linked to a digital thread. A strong revision and control process can account for all product changes and ensures everyone involved in the product development activity is aware of these changes and can help to ensure no homologation task is missed or forgotten. Further, it can ensure that everyone is working on the latest information, reducing and eliminating wasted effort on out-of-date information.

**Effectively speed up your product development process through digitalization**

Due to increased complexity in the automotive landscape caused by high tech companies entering the market (pushing the boundaries of innovation and performance), ever changing consumer demands and the focus on more sustainable products and processes, OEMs need to accelerate their product development with digitalization.

A comprehensive digital twin and thread allows synchronizing up-to-date information and data sharing throughout the product development ecosystem. Using virtual validation methodologies, requirements can be rapidly met and design mistakes can be solved at an early stage, ensuring high quality, less recalls and reducing unnecessary failure and cost, allowing manufacturers to profitably deliver the next generation of cars and stay ahead of the competition.



OEMs need to accelerate their product development with digitalization, allowing synchronizing up-to-date information and data sharing throughout the product development ecosystem.