LIFECYCLE INSIGHTS

BUILDING SMART, CONNECTED PRODUCTS

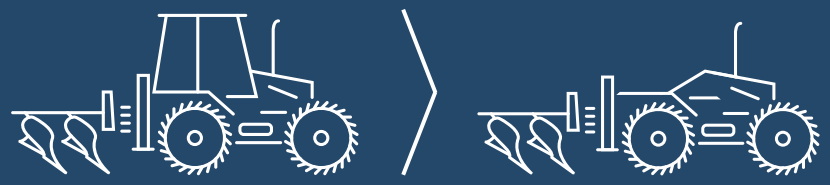
Leading Manufacturers Reduce Product Development Challenges with These Key Technology Enablers

PREPARING FOR THE SHIFT TO SMART, CONNECTED PRODUCTS

Many manufacturers are moving away from traditional, mechanical products and towards smart, connected ones. To deliver the smart features today's customers now demand, manufacturers must incorporate electronics, electrical systems, and software into their products.

This shift impacts every stage of the design and development process. It also introduces tremendous challenges for product development companies. Most manufacturers don't have the competencies to design and develop these electronic, electrical, and software systems, so they must turn to suppliers who do. The resulting partnerships between manufacturers and suppliers require close collaboration during the product development lifecycle.

This eBook examines the methods and key technology enablers that keep companies competitive during the transition to smart, connected products. It also shares exclusive findings from the Lifecycle Insights 2020 Engineering Executive's Strategic Agenda study.



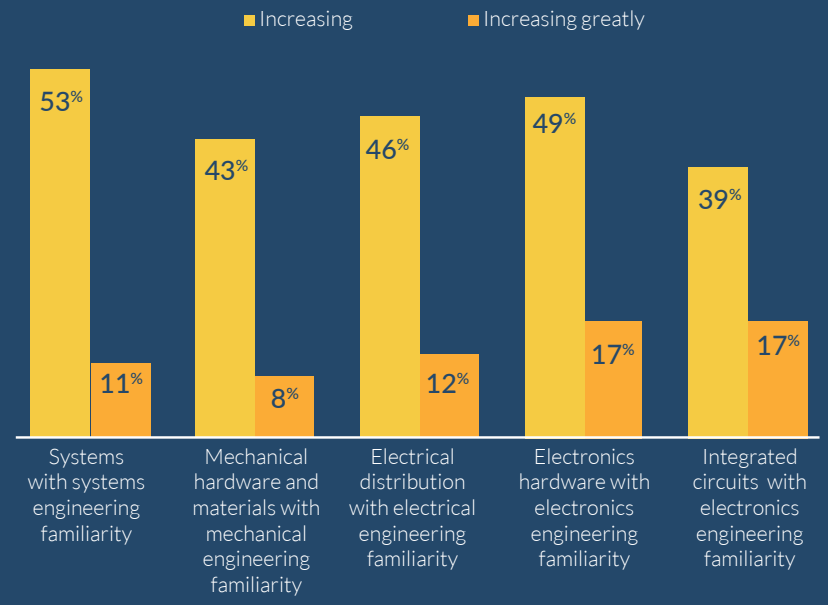
The shift from traditional, mechanical products to smart, connected ones drives many changes and challenges across the product development process.

RISING COMPLEXITY ACROSS DESIGN DOMAINS

The shift to smart, connected products is fraught with challenges brought on by rising complexity across all design domains. Customers and markets now demand advanced, intelligent features. Compared to traditional products, these features require more processing power, faster sensor-enabled sampling, and more network bandwidth. Satisfying these demands is no simple task.

Findings from the Lifecycle Insights 2020 Engineering Executive's Strategic Agenda study quantified these issues. The majority of respondents stated that the complexity in each design domain is increasing or increasing greatly. As a result, engineers are expected to design, develop, and deliver increasingly complex products, but within the same timeframes.

Companies can address this challenge with one of two approaches. They can develop more internal competencies for each design domain. Or, they can partner with suppliers that augment their existing competencies. What's important is the domain-specific expertise; it doesn't matter whether it is in-house or spread across a supply chain. Collaboration and coordination are key, allowing everyone to work together closely to develop these increasingly complex products.



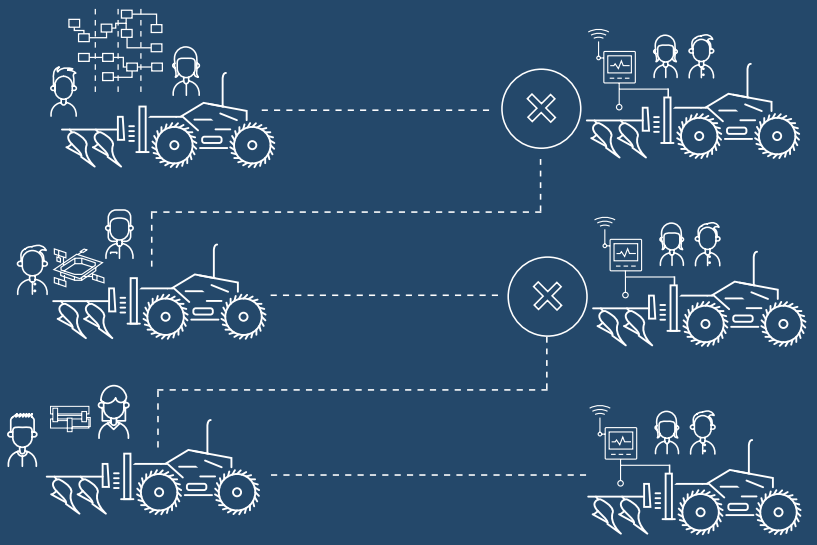
Findings from Lifecycle Insights' 2020 Engineering Executive's Strategic Agenda study show that complexity is rising across every engineering domain. The changes to systems engineering, electronics, and integrated circuits have been particularly difficult.

DRAWBACKS OF THE TRADITIONAL APPROACH

During a traditional development process, domain-specific engineering teams or individual suppliers work independently on the design assigned to them. Each team or supplier works hard to satisfy the requirements assigned to their product area. They iterate and explore new design options, verifying their design work meets those requirements. But the combination of their focus on their own work and lack of visibility into other teams' progress can result in unintended conflicts and integration issues. Worse yet, these issues usually don't become evident until the prototype-in-testing phase.

When development hits the testing phase, the work from the design teams comes together. Everything is connected and assembled into a working prototype. This is often the first time the design work from different teams and suppliers are brought together—so this is also the first opportunity for unwanted systems behavior and performance issues to manifest themselves. It is not uncommon for prototypes to fail to initialize and outright fail.

Such issues initiate a cycle of root-cause analyses to identify the problem. This often leads to the development of new design modifications and, potentially, a new prototype-in-testing phase. The test results provide little or no insight into why a test has failed, making root-cause analysis a long and arduous process. The new design may or may not resolve the issue. Designers are flying blind, and this cycle of re-evaluation and repeated prototyping can occur multiple times, incurring significant costs and causing delays across the development process.



The traditional product development process is characterized by siloed approaches for each engineering domain, leading to systems integration issues and poor performance. This causes multiple rounds of prototyping and testing, resulting in delays and cost overruns.

ADVANTAGES OF THE PROGRESSIVE APPROACH

The progressive approach is different from the traditional one. In this approach, engineers still focus on the requirements within their design domain. However, they can access the evolving design work from other engineering teams and suppliers. All engineering teams now have visibility into the dynamic work-in-process changes in other domains and across the product. They can also request and negotiate changes with other teams.

When the work from the engineering teams first comes together during the prototype-in-testing phase, there is a high likelihood of success. This is because the cross-team visibility throughout the design phase leaves little room for misinterpretation or miscommunication. Every team can still focus on its own requirements, while being aware of other teams' requirements.

As a result, far fewer prototyping and testing rounds are required, expediting the design and development process. The engineering organization, therefore, does not waste time or money on repeated prototypes and testing. Plus, it can meet its key project milestones across the development process with ease.

The progressive product development process fosters collaboration early and often, ensuring everything begins and stays on the same page. As a result, companies can avoid the disruptions of multiple rounds of prototyping and testing.

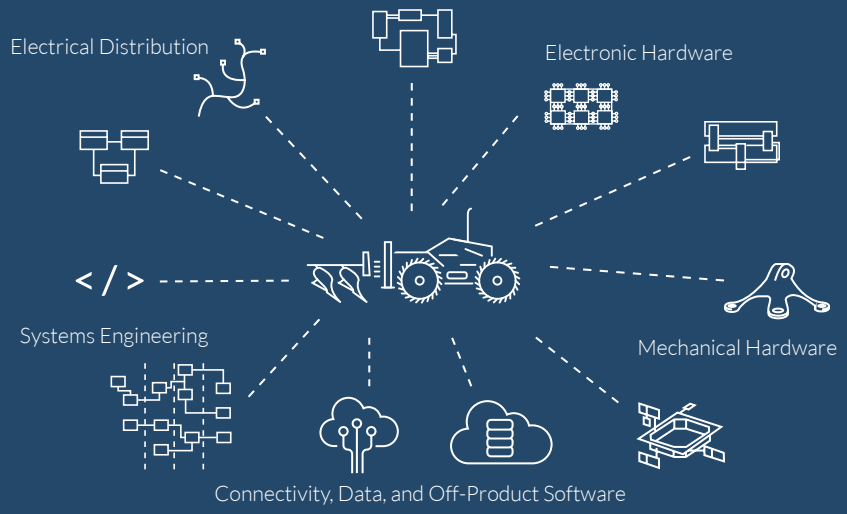
COLLABORATING ON THE DIGITAL TWIN

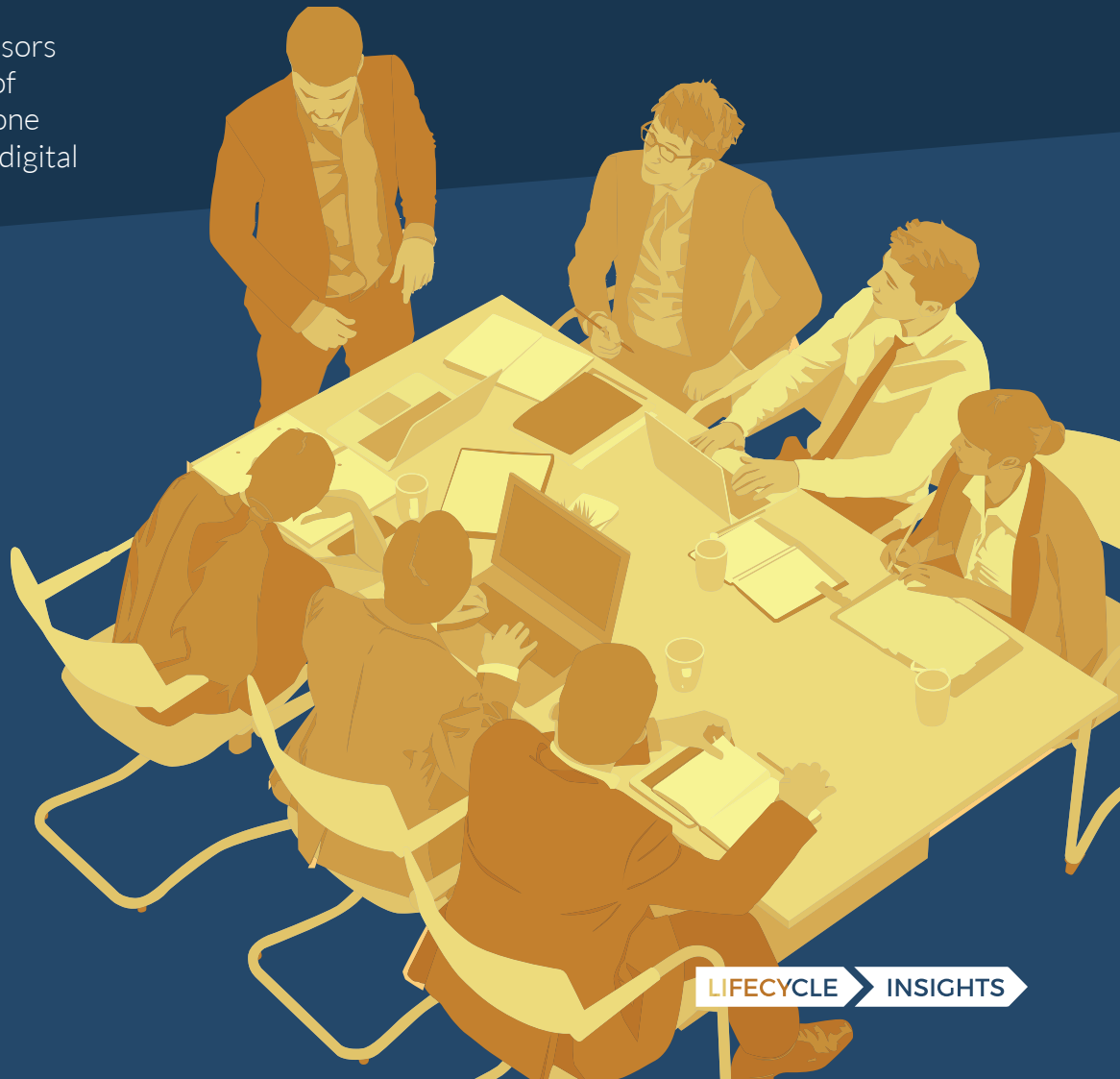
A digital twin is a key enabler of the progressive approach, because it allows organizations to manage the design work of each team as an authoritative source of the truth. All design teams can access this digital definition. So, everyone can stay on the same page throughout the development process.

Managing a product's digital twin in a single system enables mass collaboration. For example, teams can check whether circuit boards fit into enclosures. They can ensure the software is compatible with the product's processors and electronics, and that the sensors send signals through electrical systems with the right amount of bandwidth. This is an important capability because changes in one area of the design can have a dramatic effect in other places. A digital twin allows everyone to stay on the same page.

A product lifecycle management (PLM) solution is the right fit for a digital twin. Using a PLM solution, teams can either manage these definitions directly or connect to workgroup data managers or other solutions to get a holistic view of the digital twin.

A comprehensive digital twin is a key enabler for early and frequent collaboration. It allows all stakeholders to share an unambiguous definition of designs in each engineering domain.



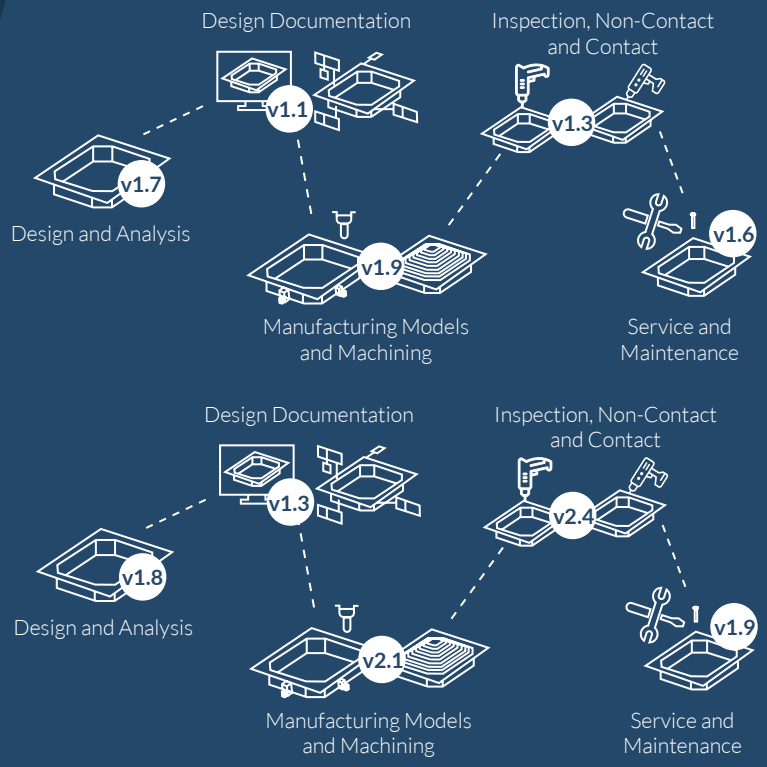


TRACKING AND MANAGING THE DIGITAL THREAD

During the development process, stakeholders create a range of derived deliverables. A machinist, for example, may reference the 3D model when developing an NC toolpath. A procurement agent may include a 3D model in a technical data package, allowing suppliers to develop quotes or proposals. In other words, these deliverables are interconnected, and any changes made in one area of the design must be propagated down this string of derived deliverables. This concept applies across design domains, from one functional department to another, and to a supplier's external participants.

This concept of interconnected deliverables is one consideration of the digital thread. Another consideration is that deliverables iterate and change over time. So, it is critical to not only propagate any changes across these deliverables but also record those changes over time, offering a historical trail of traceability. When organizations can achieve this, they enjoy seamless collaboration and an expedited design process.

PLM solutions allow organizations to track and manage the digital thread across their engineering teams and functional departments. Contributors can manage their changes with ease and exchange definitions between engineering disciplines. The PLM solution provides an authoritative source of the truth for all stakeholders, helping them collaborate and keep up-to-date with the entire product design.



A digital thread tracks changes to sets of interconnected design deliverables over time, ensuring everyone stays up to date with modifications.

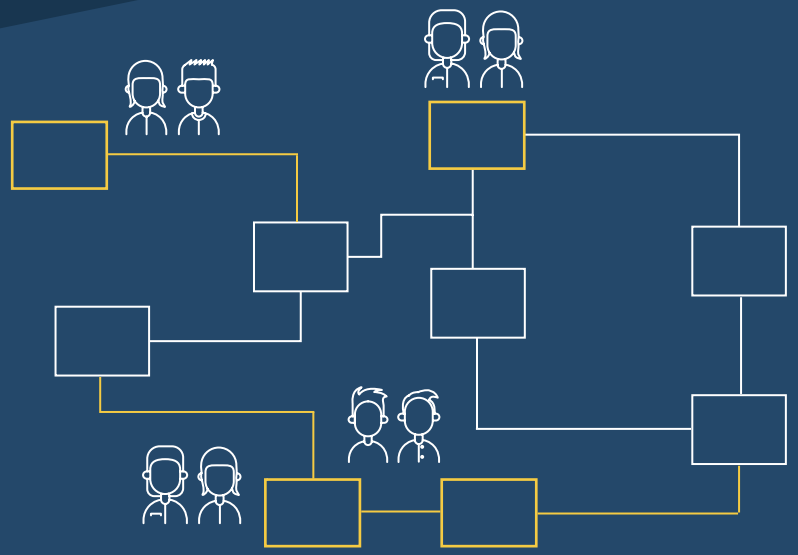
EFFICIENCY AND PRODUCTIVITY WITH SAAS PLM SOLUTIONS

A key part of the PLM solution is the ability to configure or customize it to match the practices and standards within a company. This breeds familiarity with users and enhances productivity. However, initially, a PLM solution is often a blank slate upon which a company can build its practices and standards.

Some cloud-based, software-as-a-service (SaaS) PLM solutions come with built-in best practices curated by the solution provider. This is an important capability, allowing companies to seamlessly adapt a PLM solution to match their exact needs, practices, and standards.

Sometimes, for example, these best practices are tailored to the organization's industry. These built-in standards act as the new best practices within the company. Alternatively, the organization can use these built-in standards as a baseline to make further changes and introduce new standards.

Either way, companies can significantly adapt the configuration of a PLM solution to meet their exact needs.



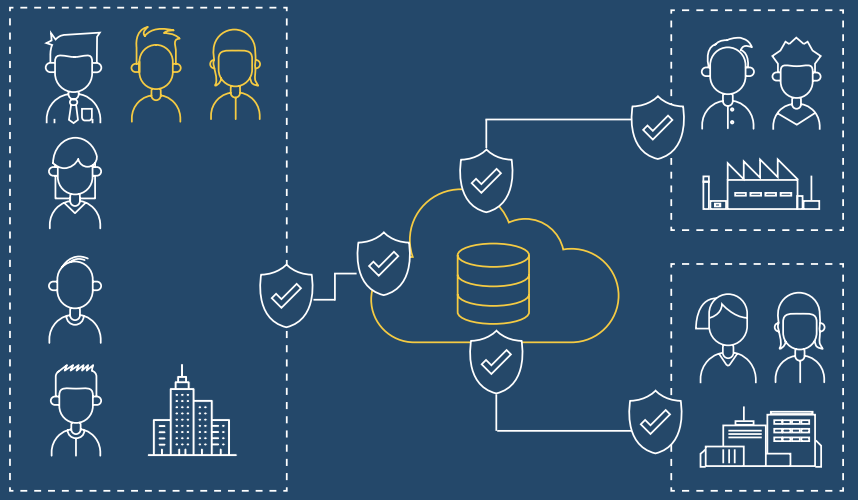
Companies can change a PLM solution to meet their specific needs. Some SaaS PLM solutions come with built-in best practices that can enhance a company's development process or act as a baseline for other modifications.

FAST ACCESS WITH SAAS PLM SOLUTIONS

It can take months, or even years, to implement a traditional PLM solution. It also requires a significant number of IT resources. But today's product development challenges are too acute to wait. Companies need solutions now, and those solutions must be both cost-effective and capable of delivering requirements management and multidisciplinary BOM management, as well as project and program management capabilities. A cloud-based, SaaS PLM solution can meet these demands.

SaaS PLM solutions provide quick access, so users can immediately address their needs. A company simply purchases a license or subscription to access a SaaS PLM solution, dramatically reducing the time from payment to use. Users can seamlessly connect to a SaaS PLM solution through a browser, giving them access to the solution any time, from anywhere, and on any device.

SaaS PLM solutions also require minimal IT support. These solutions do not need to be installed, updated, or customized. As such, design teams can utilize these solutions with little to no support from an organization's IT staff. This not only provides the design teams with increased independence, but also frees a company's IT teams from any ongoing support and operations and maintenance responsibilities.



SaaS PLM solutions provide quick access to address immediate needs and require little to no IT support. These solutions offer an accelerated path to the capabilities that today's companies need.

RECAP AND CONCLUSIONS

The shift towards smart, connected products introduces challenges for development companies, mainly due to the rising complexity across design domains. Traditional methods struggle to provide the level of cross-team visibility and collaboration required, leading to time-consuming, costly, and repeated prototyping.

A progressive approach mitigates these risks, introducing a single source of truth in the form of a digital twin. PLM solutions play a critical role here, allowing organizations to track and manage the digital thread across their engineering teams and functional departments.

To summarize:

- To develop smart, connected products, organizations must abandon traditional development practices and adopt a progressive approach.
- A digital twin is a key enabler of the progressive approach, helping disparate teams gain visibility into one another's requirements and a holistic view of the evolving product design.
- PLM solutions allow organizations to track and manage the digital thread with ease, but these can take years to develop and implement.
- SaaS PLM solutions provide quick access to address immediate needs by providing browser-based access to users while requiring minimal IT support and offering independence to an organization's designers and developers.