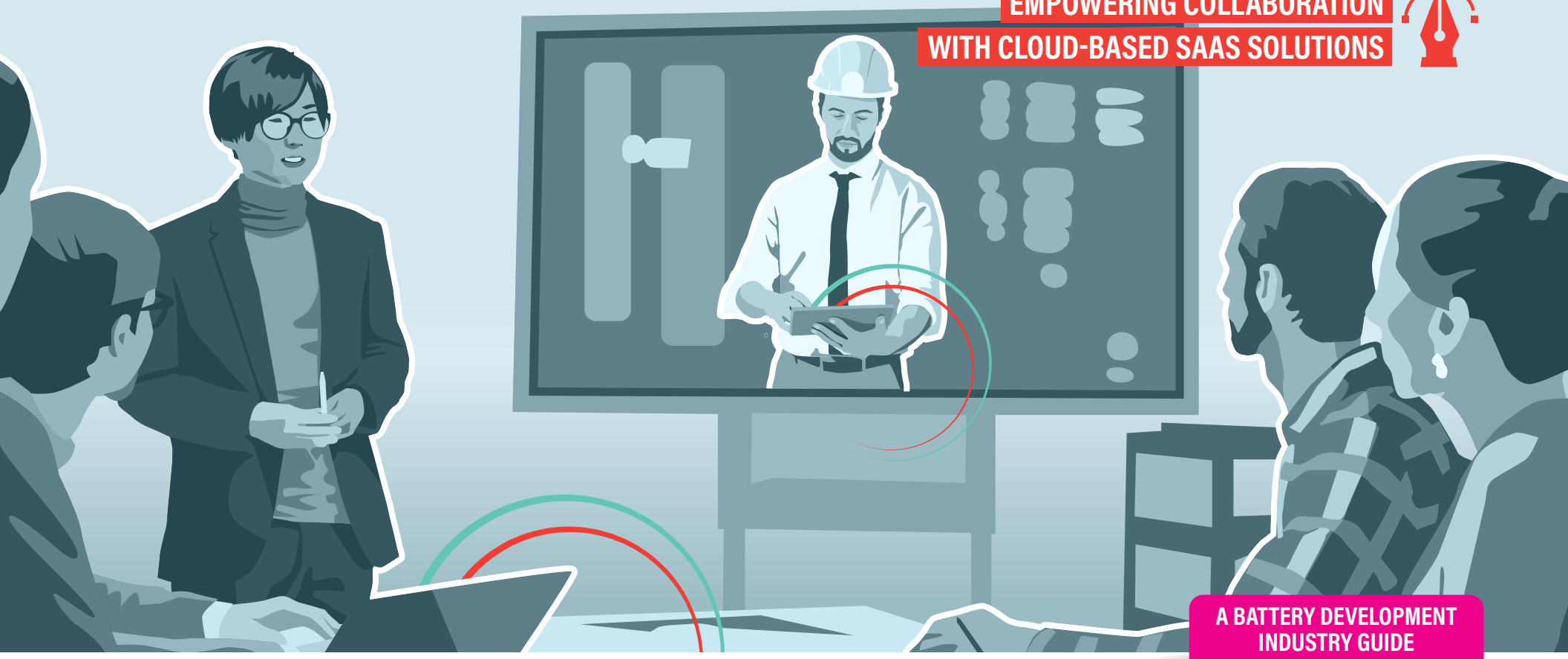
HOW DO I

COORDINATE DESIGN ACROSS ENGINEERING DISCIPLINES?

EMPOWERING COLLABORATION WITH CLOUD-BASED SAAS SOLUTIONS



A BATTERY DEVELOPMENT INDUSTRY GUIDE

LIFECYCLE INSIGHTS

Accelerating Engineering Transformation

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Introduction

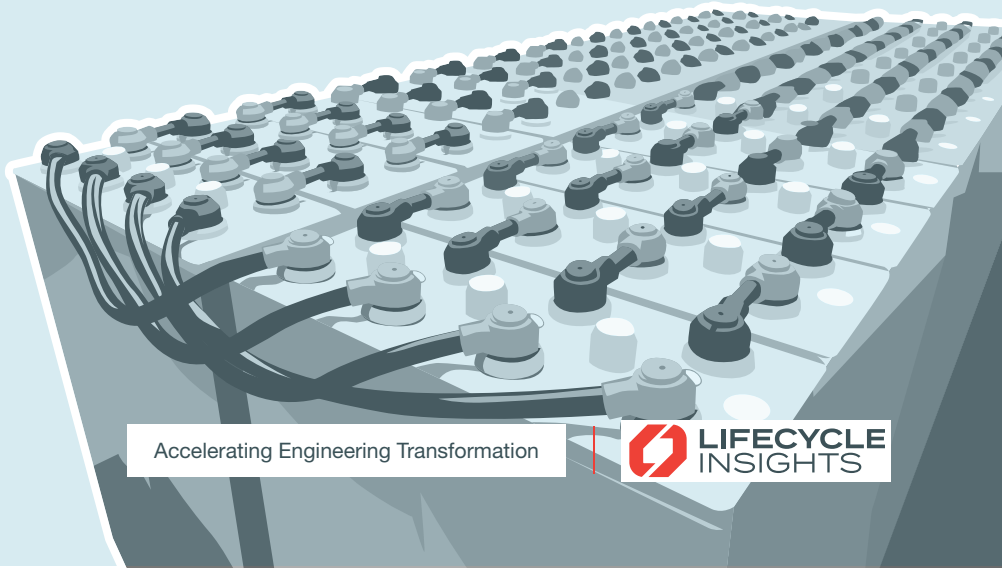
It seems like every industry is undergoing an electrification transformation in one way or another. At the center of that transformation is an increasing reliance on industrial battery systems and a rapidly growing demand for more powerful and efficient batteries.

As their market grows, battery development companies have a considerable opportunity. But developing new batteries involves numerous complex engineering challenges. Engineers face competing constraints in the form of peak power draw, high power capacity for longer vehicle ranges, long lifetimes, and low weights. The potential for thermal runaway and chemical fires also makes safety an essential concern. In addition, batteries' fundamental physics involve complex thermo-chemical interactions. Furthermore, their control systems incorporate complex electronics and software. An array of mechanical, chemical, electrical, electronic, and software engineers and analysts are needed to do the job right.

Coordinating work between these stakeholders, however, presents its own challenge. Managing product data and development processes with general purpose tools—such as shared documents and spreadsheets—makes it easy for team members to lose sight of design changes. This limits engineers' ability to make fully informed engineering decisions and increases the potential for errors that may go unaddressed prior to prototyping and testing. Projects become delayed and costs rise. Out-of-date or inaccurate information also makes procuring the right parts and managing the supply chain more challenging for those outside of engineering.

Battery development companies require more modern tools to manage the complexity of the battery lifecycle. Product lifecycle management (PLM) solutions create a single digital thread that gives stakeholders up-to-the-minute insights into design and requirements changes. This allows engineers to coordinate work across disciplines more efficiently and ensures that decisions are made based on the latest, most accurate information possible. As a result, organizations reduce errors as well as the amount of prototyping and testing required to reach a viable design, lowering costs and shortening the development cycle in the process.

This eBook is one of a series focusing on the challenges facing battery development companies and how PLM solutions can address them.



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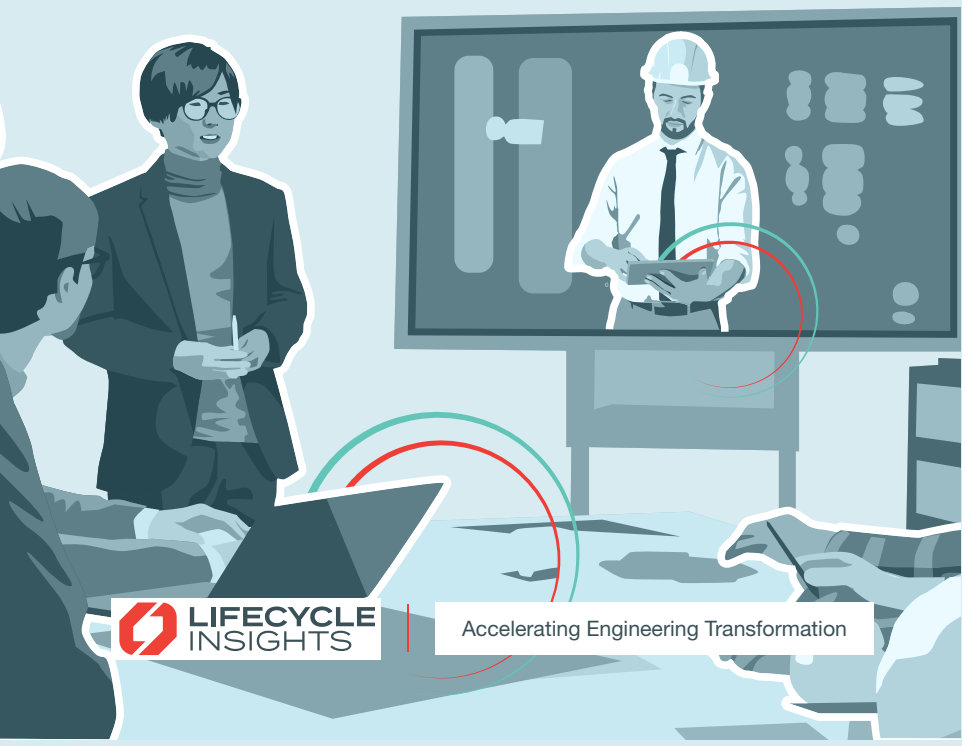

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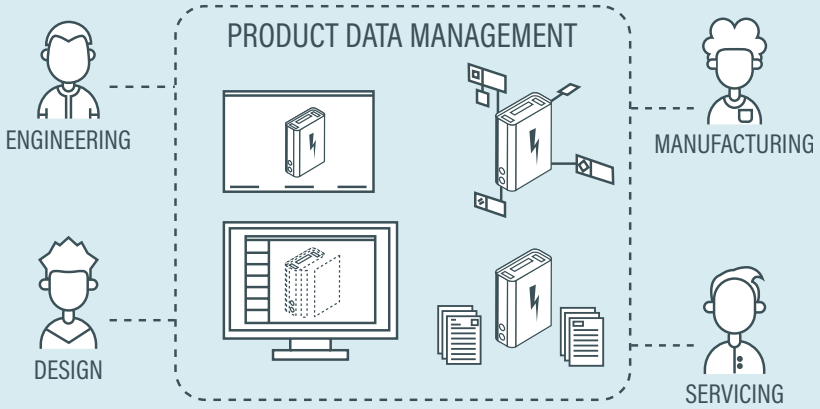
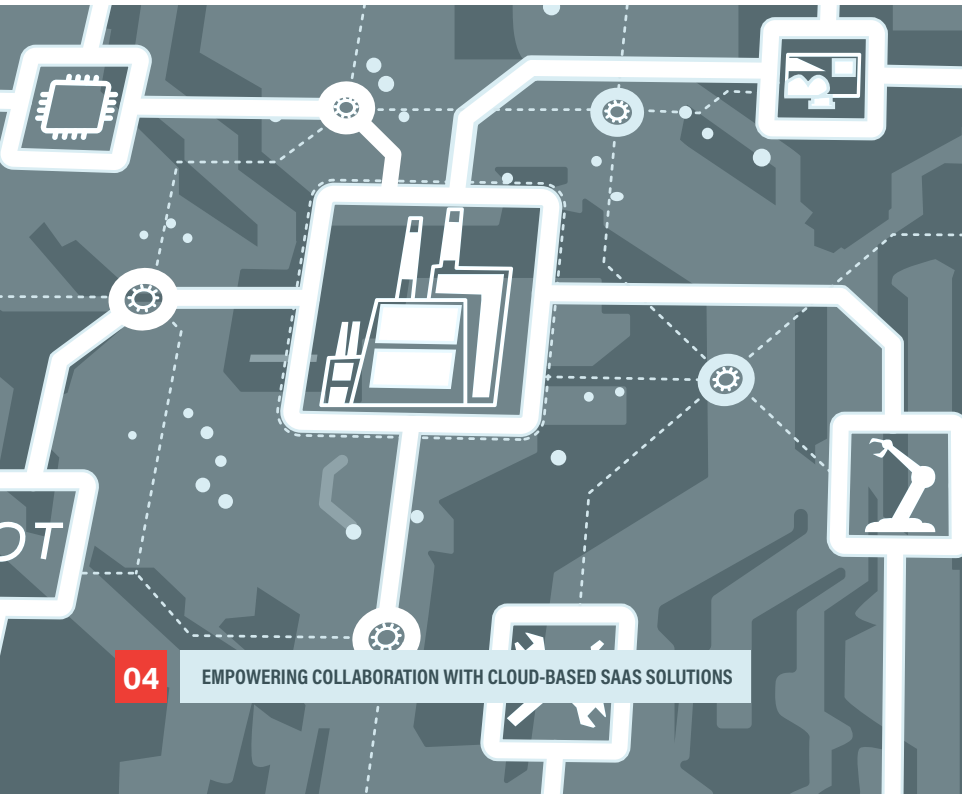


Figure 1
Data management systems provide a common digital thread connecting design, engineering, manufacturing, and service.



The Need for Collaboration Across Engineering Disciplines

Many battery development ompanies are looking to improve product development through digital transformation (DX) initiatives, including 3D computer-aided design (CAD), hybrid simulation/testing, artificial intelligence (AI) and machine learning (ML), and smart manufacturing. Yet, those ompanies need the right foundation to reap the benefits of DX. One such foundational initiative is cross-domain engineering data management.

Battery development is a collaborative process involving internal and external stakeholders. Every party, from engineering to suppliers, needs access to the latest design data. But when design data changes by the minute, how can organizations ensure everyone has the most up-to-date information? Furthermore, how can they control access so everyone can view and get what they need, even if they are working outside the company's four walls?

This eBook will focus on the challenges battery development ompanies face when collaborating and working with an ever-growing number of stakeholders—and how software-as-a-service (SaaS) product lifecycle management (PLM) can help overcome associated challenges.

Employing a Comprehensive Digital Twin

A digital twin is a digital representation of a physical item or system. In the past, these models mainly served design and manufacturing domains, but now they are incredibly comprehensive (for example, extending to maintenance and servicing). Today, the digital twin can act as a common thread between all stakeholders in product development.

The COVID-19 pandemic accelerated the adoption of the comprehensive digital twin. Work-from-home orders and social distancing mandates forced companies and teams of all sizes to find ways to collaborate virtually. This made staying abreast of the latest developments in the process a big challenge.

Having a comprehensive digital twin, however, allows different stakeholders, both internal and external, to stay on the same page. Implementing a comprehensive digital twin is not easy, but teams who saw the value were able to pull one together in a relatively short amount of time. Of course, most of those organizations already had many DX initiatives in place to support a digital twin. Today, as more organizations understand the benefits of a digital twin, they are no longer asking, "Should we do this?" but rather, "How quickly can we get this in place?"

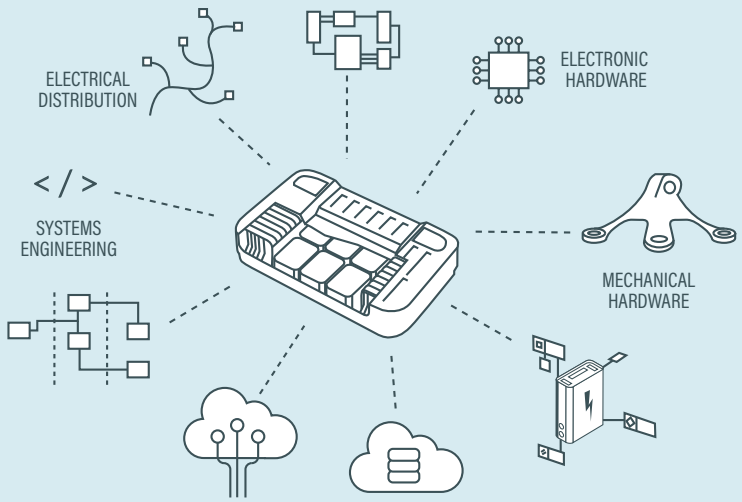
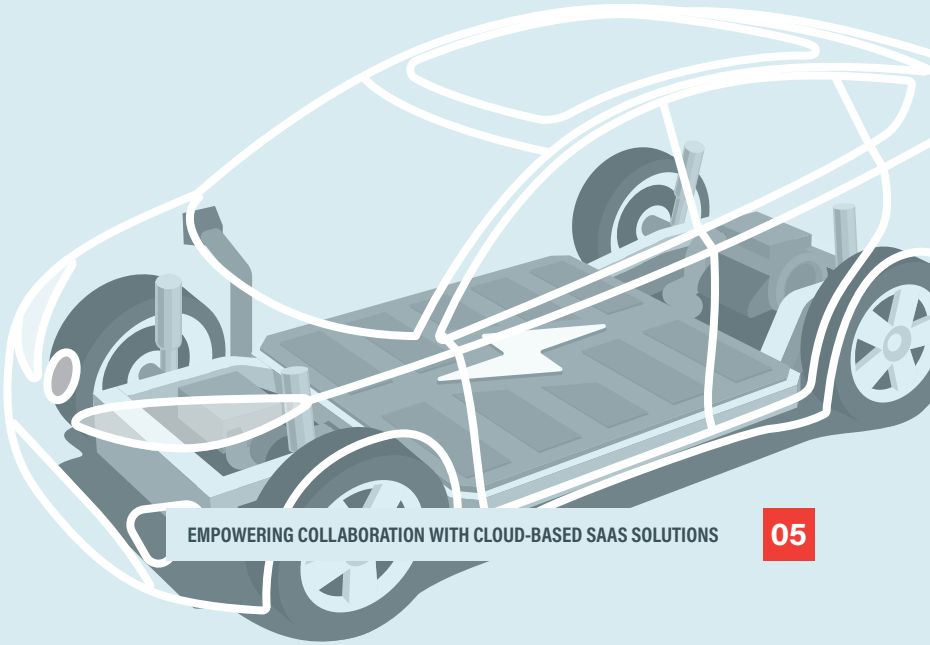


Figure 2
A comprehensive digital twin is a key enabler for early and frequent collaboration. It allows all stakeholders to share an unambiguous definition of the design in each engineering domain.



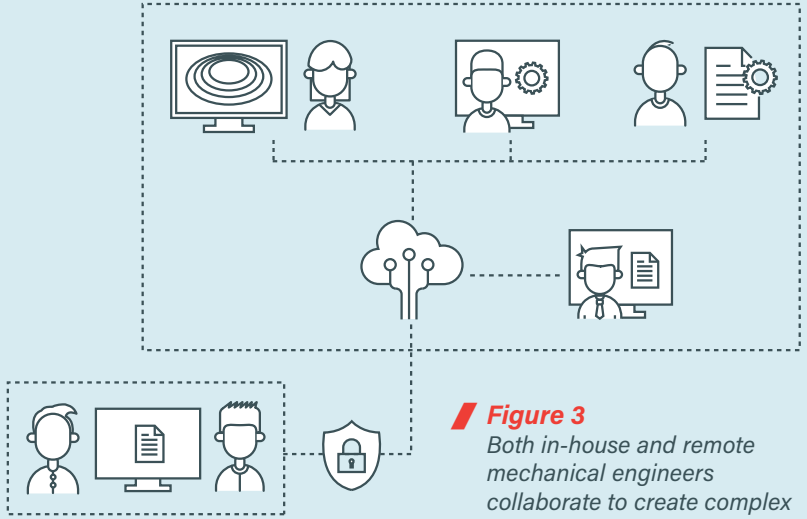


Figure 3
Both in-house and remote mechanical engineers collaborate to create complex products.

Coordinating Among the Mechanical Design Team

Developing today's batteries involves numerous mechanical engineers and designers, each working with a different set of software tools. Often, design tasks are sequential: For example, a simulation engineer will need the final design model before starting work. But, sometimes, design steps are completed in parallel. That can make it a challenge to have everything come together seamlessly to inform the final battery design.

Traditionally, this kind of complex collaboration is supported by emailing files back and forth. Some teams rely on shared drives and dedicated on-premise servers to store engineering data. The pandemic prompted others to move toward cloud-based sharing. Unfortunately, all of these approaches can lead to decisions based on faulty or outdated information.

Organizations can manage these issues by adopting a modern product lifecycle management (PLM) solution. Such platforms can manage designs from a variety of CAD packages, allow the engineering team to visualize designs, and ensure everyone is working from the same up-to-date data so they can design the best possible products.

Collaborating With Electrical and Electronics Engineers

More industries are undergoing a fundamental transformation in the shift to electrification. And that move relies on advancements in industrial battery systems. Their complexity requires input from multiple design domains. Chemical, mechanical, electrical, electronics, and software engineers must work together to bring these batteries to market. In addition, the emerging technologies today's batteries rely upon mean that even established companies will likely need to leverage outside expertise. Any product development process needs to support synergistic, collaborative working between different teams and stakeholders.

The success of any modern battery system hinges on the design team's ability to share information quickly and efficiently. When engineers work with out-of-date information, the result is inefficient designs and a higher likelihood of other costly and time-consuming failures—electronics that do not fit inside the enclosure, not enough space to route wires, insufficient cooling, shorting, and so on.

The progressive approach—using a modern PLM solution—supports an up-to-date, complete definition of the battery system, including components from all design domains. Whenever a change is made, everyone in the team is notified, including outside contractors and partners. This kind of platform provides a single source of truth that everyone can use to make informed decisions during design and beyond. Engineers can catch errors early and, overall, experience a superior cross-functional product development process.

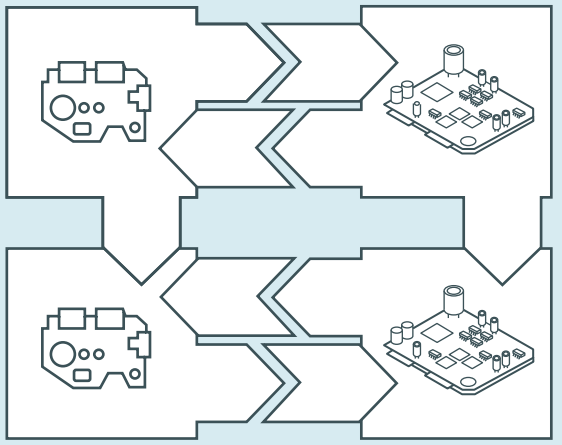
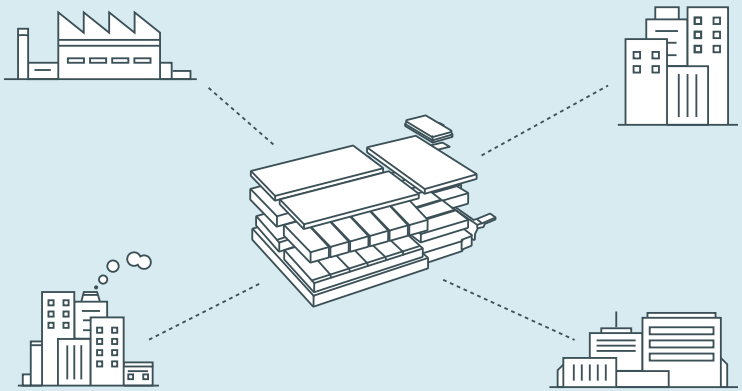


Figure 4
Engineers can exchange modifications back and forth, quickly and easily. This allows earlier and more continuous collaboration during the design process.

Figure 5

A progressive solution must allow external stakeholders like suppliers access to the latest development data to streamline the product development process.



Working With Customers, Suppliers, and Partners

Modern battery development means managing constantly evolving requirements while working closely with customers, suppliers, and other partners. Non-engineering functions like marketing and sales also need access to engineering data to do their jobs. The process is better supported when everyone can work from the same up-to-date information (requirements, design data, work in progress, project schedule, etc.).

Battery development companies that still rely on email transfer of files can find the frequency of those exchanges becoming unmanageable—and key data being lost in the process. Intellectual property can also be compromised. Furthermore, even if stakeholders can keep up, they may not have the correct software to review certain files. In the end, working from outdated or inaccurate requirements data can result in tasks going uncompleted.

Digital PLM platforms, however, can allow people both inside and outside the organization to access the latest engineering design data based on their specific roles. Such solutions keep everyone on the same page, yet allow organizations to control who can view or edit information. Even better, stakeholders can view the latest files within the application even if they don't have the necessary software packages.

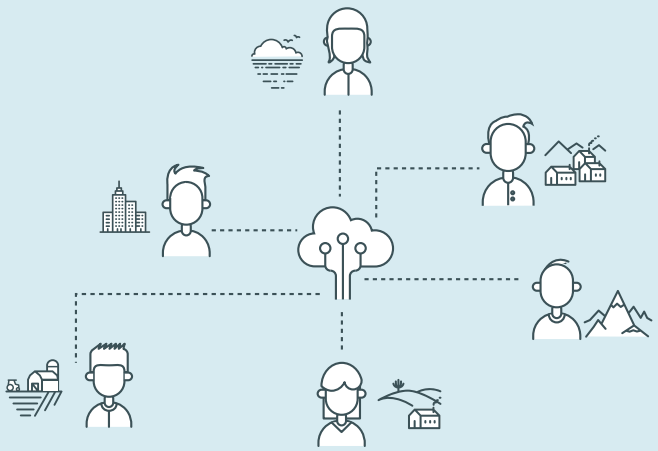


Figure 6
SaaS PLM solutions provide quick access to address immediate needs and require little-to-no IT support. These solutions offer an accelerated path to the capabilities that today's companies need.

The Advantage of SaaS Solutions

Cloud-based SaaS PLM solutions come with built-in best practices, curated by the solution provider, to support easy collaboration during the battery design and development processes. Battery development companies can use these solutions to quickly implement engineering data management. The benefits include:

- **Efficiency:** With built-in, prescriptive best practices, battery development teams can easily tailor these solutions to meet their specific needs.
- **Productivity:** Artificial intelligence/machine learning (AI/ML) algorithms give the solution an in-depth understanding of a company's workflows and processes to correct problems.
- **Fast implementation:** Users can immediately gain access through a browser without heavy IT support.
- **Distributed total ownership:** SaaS PLM subscriptions don't require a large, up-front technology investment. Instead, they distribute the total costs over time.
- **Extended collaboration:** These solutions allow input from both internal and external stakeholders. Cloud-based SaaS solutions permit easy viewing of engineering data without the need to install software.
- **Security:** Intellectual property remains secure, as collaborators only get access to the data intended for their use.

Battery development companies must have a single source of truth that allows engineering and other teams to keep up with the latest design data.

Recap and Conclusions

With the emergence of smart, connected technologies, battery development has become an even more highly collaborative process involving both internal and external engineers and other stakeholders. Battery development companies must have a single source of truth that allows engineering and other teams to keep up with the latest design data. This ensures all aspects of the product, whether mechanical, electrical, electronics, or software, meet the necessary—and competing—requirements.

The use of cloud-based SaaS PLM solutions can help battery development companies better keep up with evolving product designs, making sure everyone is working from the most up-to-date data.

These solutions' benefits include:

- improved coordination among the mechanical engineering team for more efficient designs;
- enhanced collaboration with other design domains to ensure that all requirements, regardless of design domain, are met;
- the ability to collaborate with suppliers and customers, so everyone is working from the same engineering data; and
- secure, accurate information in one centralized location to help support every step of the manufacturing process, from design to customer service.

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Lifecycle Insights is a trusted research, advisory, and publishing firm providing data-driven insights and industry-proven guidance on engineering transformation.

We empower better people, process, and technology decisions for tech-led engineering initiatives, driving the development of better products in less time.

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