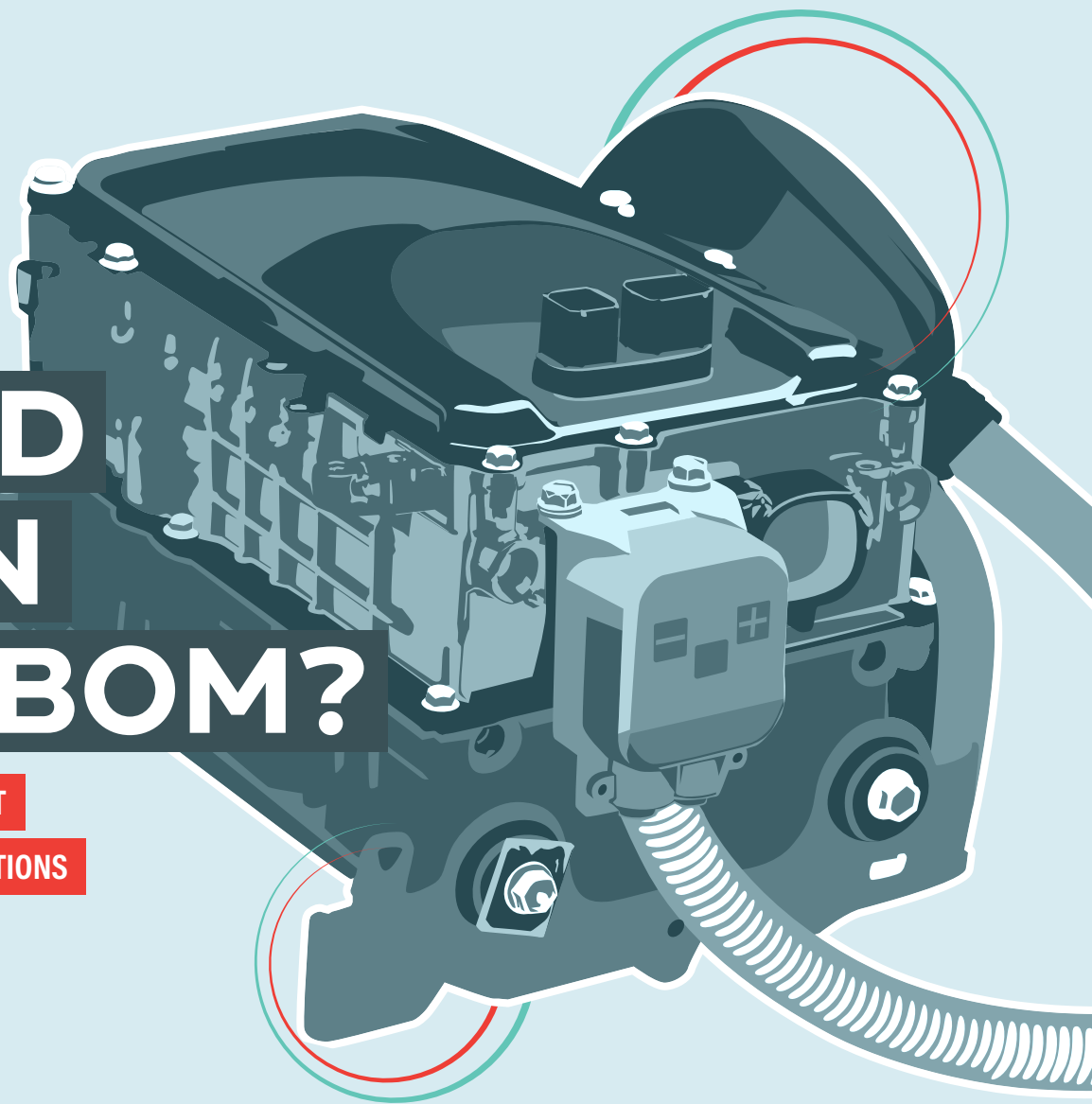


HOW DO I CREATE AND MANAGE AN ACCURATE BOM?



SIMPLIFYING BOM MANAGEMENT

WITH CLOUD-BASED SAAS SOLUTIONS



A BATTERY DEVELOPMENT
INDUSTRY GUIDE

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 Out-of-date or inaccurate information also makes procuring the right parts and managing the supply chain more challenging for those outside of engineering.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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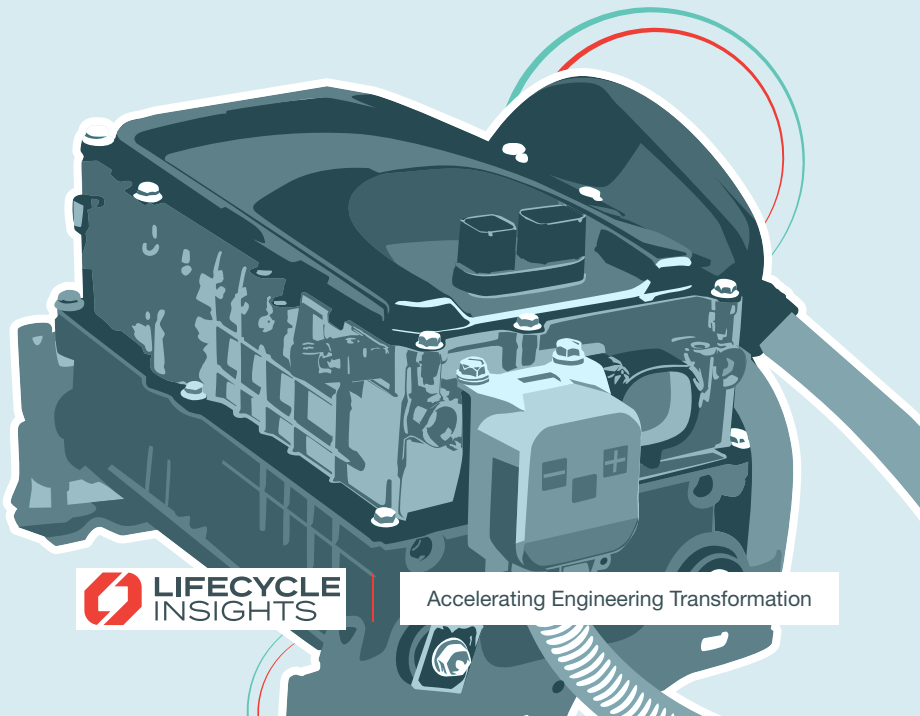


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The Role of the Bill of Materials in Development

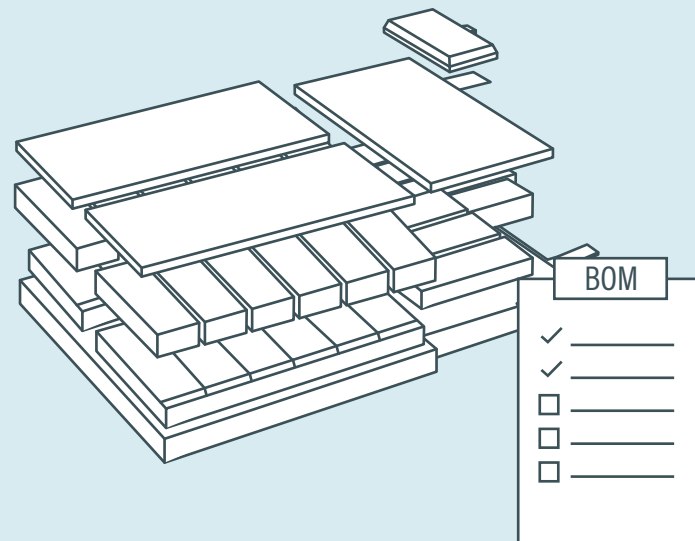
The bill of materials (BOM) is a critical piece of battery development. Once engineering develops this deliverable, downstream departments use it to guide development, from design to manufacturing to regulatory approvals and certifications. Thus, the BOM is key to many stakeholders, both internal and external to the battery development company, including departments such as manufacturing, procurement, sales, finance, and servicing.

Each functional department tweaks and modifies the BOM for its own purpose. Engineering relies on it to track revisions and changes, meet cost targets and satisfy product requirements for performance, environmental compliance, serviceability, and safety. Manufacturing uses it to plan manufacturing processes and assembly operations. Procurement harnesses it to source components. Service refers to it to plan service operations and spare parts provisioning. Management looks to the BOM to assess risk and formulate a risk management strategy.

This eBook will focus on the challenges of BOM management and how a cloud-based software-as-a-service (SaaS) approach can help battery development companies overcome those challenges.

Figure 1

The BOM is a critical deliverable in product development which is used by multiple departments.



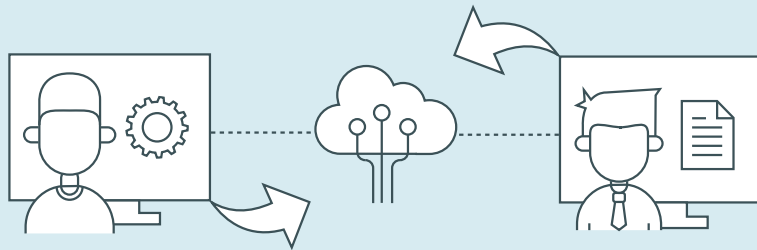


Figure 2
BOM creation and management is a collaborative process.

The Challenges in Developing the BOM

The BOM is an important deliverable in modern product development. Product development teams create, manage, and finalize the BOM during the design cycle. But modern BOM development has several challenges that battery development teams are looking to overcome.

To start, the increase of smart functionality and other advancements in battery technology means battery development teams are facing increasing product complexity, requirements, and variability. Continuous cost pressure also forces teams to standardize components and pursue economies of scale. This translates into a much more complex BOM—and more complicated BOM management. Companies in the battery development sector are looking for better ways of developing and managing the BOM.

The BOM is crucial to the entire development process, so any shift in its creation or management must be at least as efficient and cost-effective as the traditional method. In addition, many are looking for ways to “disruption-proof” this deliverable so they are better prepared to meet challenges like the COVID-19 pandemic. Modern product lifecycle management (PLM) solutions offer hope through superior workflows.

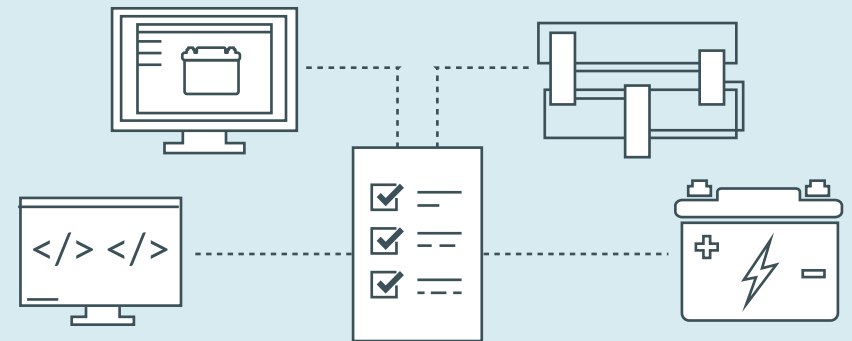
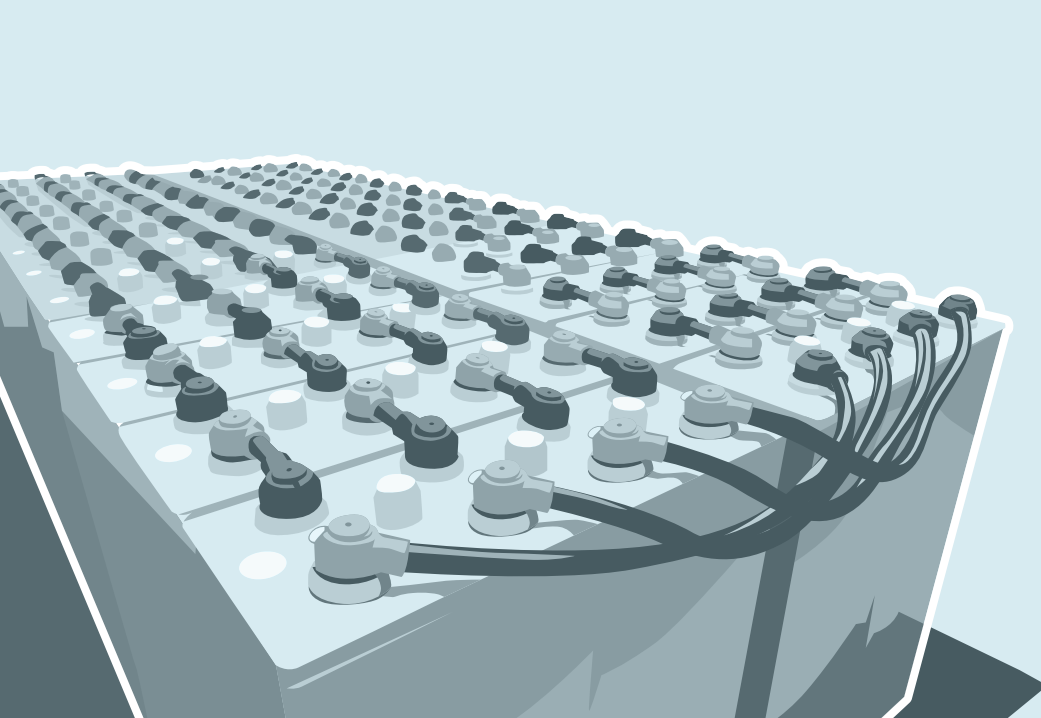


Figure 3

The BOM may contain data from mechanical CAD, electrical CAD, electronics EDA, and software and should update automatically when the data changes.

Synchronizing the BOM With Many Data Sources

Today's smart, connected batteries include mechanical, electrical, electronics, and software components. Naturally, the BOM needs to reflect this and include data from various stakeholders and software programs. Different departments rely on the BOM to make decisions, so it must link to computer-aided design (CAD) data and supplier component databases to ensure the information is current and accurate.

Maintaining and updating all this data is challenging. People responsible for the BOM must ensure that the BOM updates as the CAD model changes. Traditionally, battery development teams have used emails or spreadsheets to keep up with this information. However,

manually updating those sources can be time-consuming and error-prone, resulting in stakeholders editing outdated versions.

Luckily, modern PLM software tackles those issues. Such solutions can automatically generate the BOM based on existing templates whenever CAD models are checked in. Changes to the model update the BOM in an intelligent manner, keeping any exceptions defined by the engineer. These solutions provide an elegant, automated way to synchronize the many sources of internal and external data needed to complete the BOM.

Leveraging the BOM in Each Functional Department

Many functional departments use the BOM for further analysis to make critical decisions. Engineering uses the BOM to determine whether requirements for cost, regulations, and form, fit, and function (FFF) equivalents have been met. Manufacturing consumes the BOM to guide production. Procurement looks to the BOM to study supply-side risks and take appropriate mitigation measures. Finance relies on an accurate BOM to perform inventory cross-checks. Truly, the BOM is a central asset.

That is why it is vital for the BOM to be a single source of truth. The analysis data (cost analysis, risk analysis, etc.) created using the BOM is very valuable and must be linked back to the BOM to make it available to all stakeholders. The visualization of this data, its reliability, and its accessibility are crucial.

Traditional, document-based BOM management cannot ensure these fundamental requirements. A modern PLM solution, however, not only creates the BOM automatically, but manages and integrates all BOM-related analysis data. It enables the various departments to create strategies (costing, assembly planning, risk mitigation) from the BOM. This data can be accessed across the organization, even by remote teams using a digital thread, to make sound business decisions.

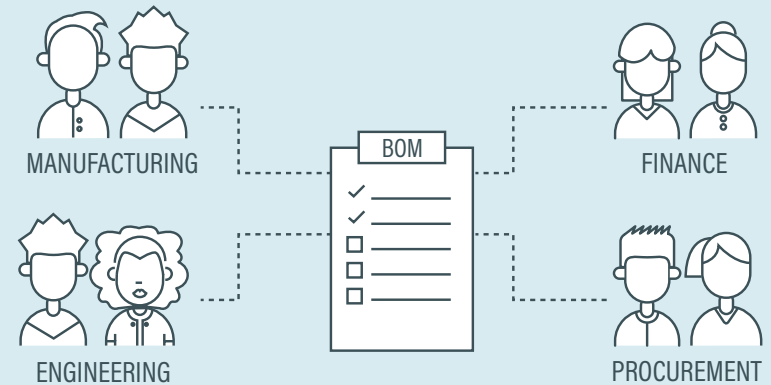
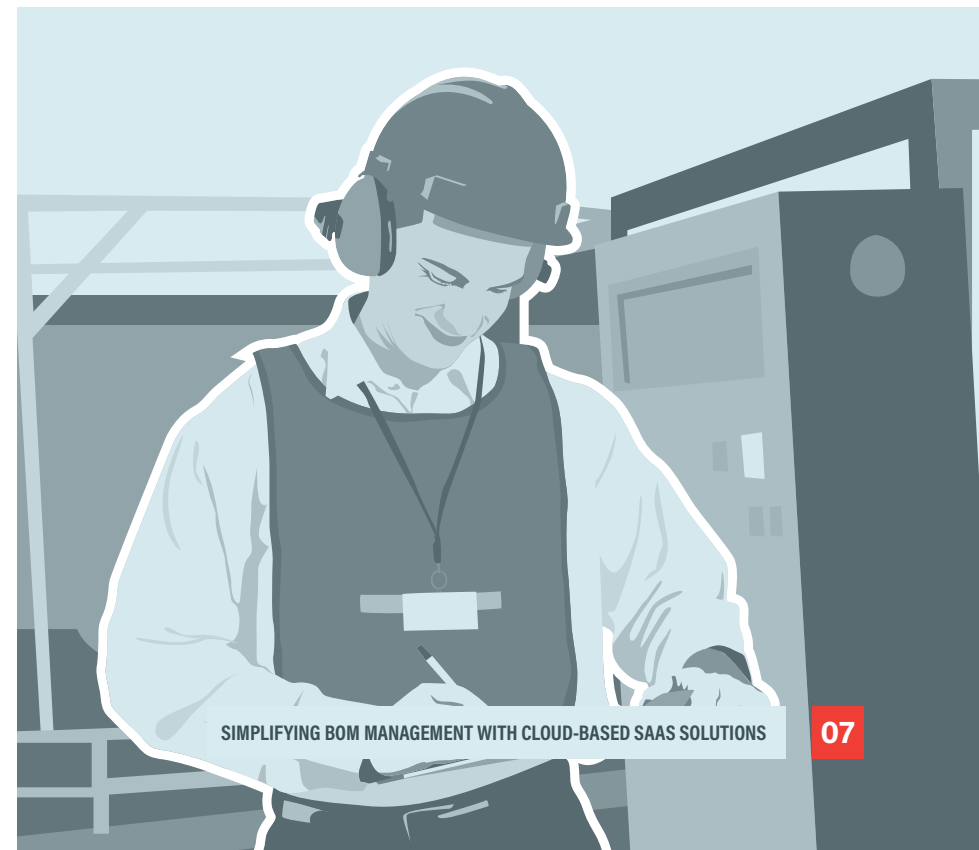


Figure 4

The BOM is used extensively by various functional departments such as manufacturing, finance, and procurement.



Handling Variability With the BOM

Many products come with different variations. Take batteries: There are zinc carbon, alkaline, button cell, and lithium varieties. There are also many size and chemistry options available for different applications. Battery development organizations use marketing data to determine how many of each variation to manufacture. These decisions directly affect procurement, inventory management, and sales—all of which need accurate, up-to-date data to perform their functions efficiently. The BOM plays a critical role here.

But the traditional spreadsheet method of handling the BOM only exacerbates existing challenges when variability is involved. Variability means more complex spreadsheets, higher probability of mistakes, and increased likelihood of delays when stakeholders try to manually

incorporate all changes into all the associated files. Inefficient and cumbersome BOM management is a recipe for disaster.

When an organization implements PLM-based BOM management, however, it can automate BOM generation to take care of variability. This can be done right from the requirements stage when engineers build the CAD model and first develop the BOM. Any later additions or deletions can be handled seamlessly, ensuring that all costing, manufacturing process planning, service engineering, inventory management, procurement, risk management, and certification-related tasks are informed by accurate, reliable data.

Figure 5

A progressive, PLM-based BOM management solution automatically handles variability.

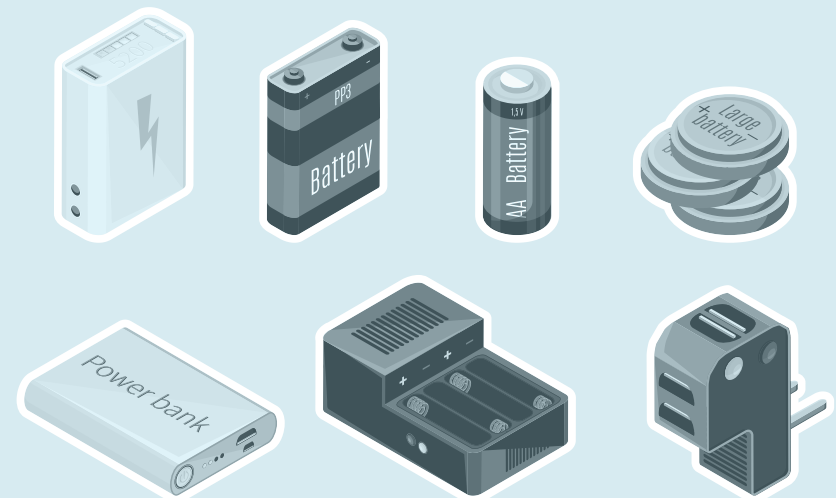
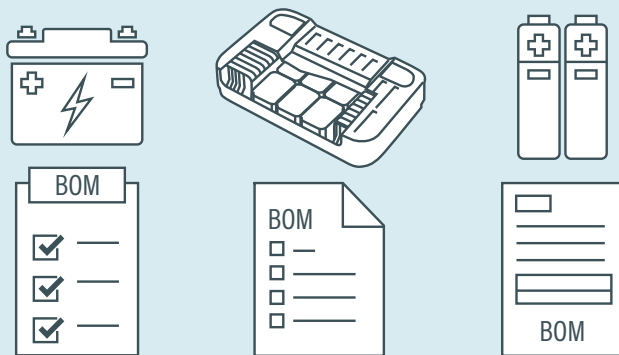
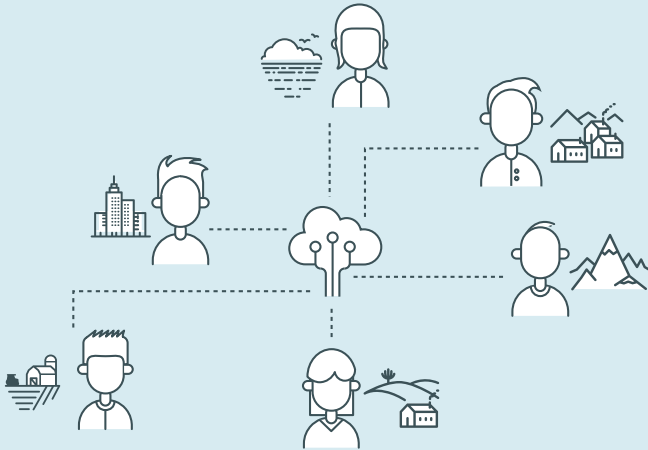


Figure 6

SaaS PLM provides quick access to critical capabilities like BOM management with little IT support.



The Advantage of SaaS Solutions

Cloud-based SaaS PLM solutions offer built-in, provider-curated best practices, either tailored to the battery development industry or configured by the customer to meet their exact needs. The result is quicker, more accurate BOM creation and management. These platforms offer the following advantages:

- **Efficiency:** Battery development teams can easily customize built-in, prescriptive best practices to meet their specific BOM-related needs.
- **Productivity:** Platforms include artificial intelligence/machine learning (AI/ML) functionality to help identify issues within company workflows and reduce friction during collaboration.
- **Fast implementation:** Because these solutions are cloud-

based, users can easily access them from any browser. Battery development teams can purchase a subscription and implement these solutions with less 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:** BOM creation requires input from both internal and external stakeholders. Cloud-based SaaS solutions permit easy viewing of engineering data without the need to install expensive software.
- **Security:** The internal IP is always protected, as teams can set their own standards and permissions for both viewing and editing.

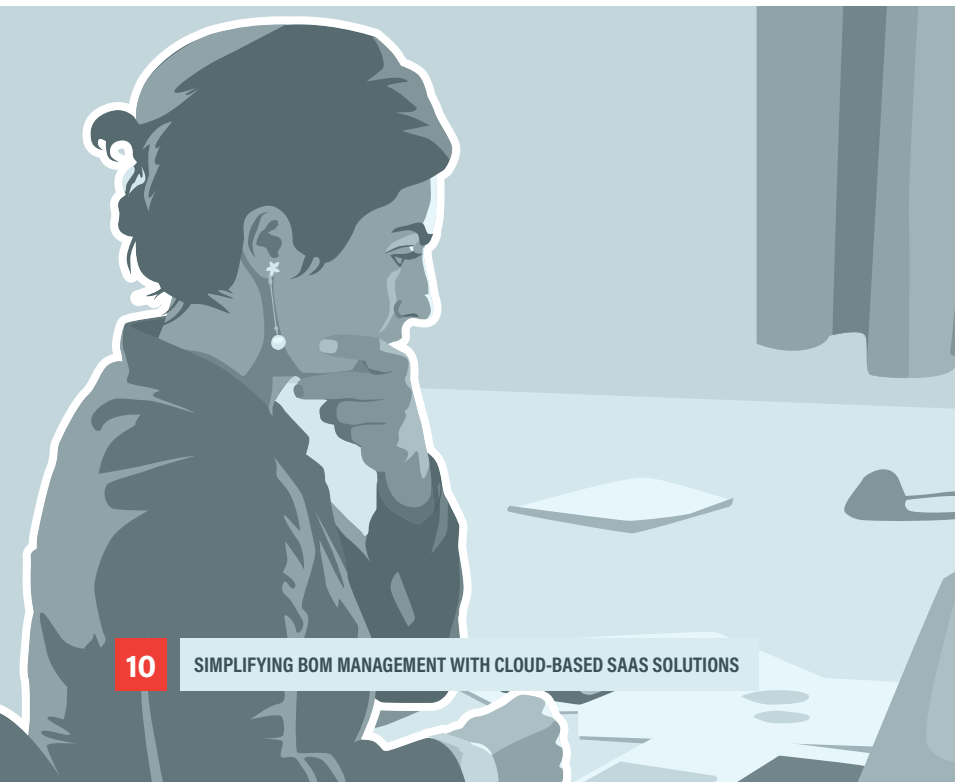


Nearly all functional departments in any battery development company rely on the BOM to do their jobs. It is vital that these companies support a collaborative BOM creation process.

Recap and Conclusions

Nearly all functional departments in any battery development company rely on the BOM to do their jobs. It is vital that these companies support a collaborative BOM creation process and provide sound management of changes to the deliverable over time. Spreadsheets, screenshots, and emails cannot provide stakeholders a single source of truth. But taking a more progressive approach and investing in PLM solutions can help ensure everyone in the company is working from the most accurate and up-to-date BOM.

- Modern PLM solutions can easily synchronize multiple sources of data to ensure the BOM includes information from all design domains.
- As the BOM is the basis for essential tasks across multiple downstream departments, it is important that stakeholders can easily access the most up-to-date version of the BOM.
- With the right technological foundation, the BOM can easily keep track of the variability of products, providing key data on different options that will need to be manufactured.
- PLM solutions, including cloud-based SaaS options, help progressive organizations overcome many BOM creation and management challenges.





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