

How to Enhance your PLM to Effectively Manage Increasing Product Complexity

Meet growing customer demands, minimize risk of errors and get products to market faster by expanding the capacity and capability of your PLM systems with collaborative Configuration Lifecycle Management

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Executive Summary

Digital transformation is a hot topic in manufacturing, with initiatives like Industry 4.0 commanding C-level attention. One would be forgiven for thinking that digital transformation of manufacturing has only just begun, when in fact, the digital automation of production and business processes through IT has been underway for decades.

Today, IT systems like Enterprise Product Lifecycle Management (PLM), Resource Planning (ERP), Manufacturing Execution System (MES) and Customer Relationship Management (CRM) are the pillars on which modern manufacturing is built. Each of these systems is focused on supporting a specific functional discipline. PLM supports product design and engineering, ERP /MES supports logistics and manufacturing, while CRM supports marketing and sales. Today, in order to fulfill their commitments, each departmental function depends on the support of their respective IT systems, leading to highly sophisticated and often complicated system implementations.

However, the markets in which manufacturers operate are changing. Increasing customer demands and fiercer global competition is colliding with lower customer tolerance for errors and unwillingness to wait for higher quality products. Meeting these increasing customer demands with high quality faster than competition is now the basis for competition.

Fierce global competition is also leading to customer expectations of more choice and customization. To meet these demands, products are becoming more complex, offering a variety of options and configurable features that satisfy customization requirements in a cost-effective manner. The result is more complex products with inherent quality risks, requiring more complex testing, which in turn challenges product delivery schedules. Managing the growth in product complexity is now the major challenge that manufacturers face on their digital transformation journey.

Intuitively, one would expect the engineering department and PLM vendors to lead the charge in addressing product complexity. Scaling PLM to accommodate product configuration lifecycle management is certainly an option, but this assumes that product configuration complexity is solely an engineering concern. In fact, product configuration is a cross-functional concern as all departments from engineering to manufacturing, marketing, sales and service, require reliable and up-to-date product configuration information in order to execute their tasks efficiently.

Making PLM systems the home for product configuration lifecycle management requires opening the PLM system to all departments so that they can access product configuration information. This information needs to be reliable, up-to-date and provided without delay in cases where, for example, sales is trying to close a deal or products need to be serviced in the field. It must also accommodate the product configuration options that are important to other departments, but not necessarily important to engineering. Above all, it needs to be able to scale to accommodate the millions of configuration options that can be made available over the lifecycle of a product.

Alternatively, a dedicated solution can be used for Configuration Lifecycle Management (CLM) that can be shared between all departments, integrated with each functional department system and designed to scale and deliver instant validation of product configuration option enquiries. CLM solutions manage the particular challenge of growing product configuration complexity without requiring individual departments to radically change their work practices, or to change the intended use of their supporting systems, such as PLM.

CLM solutions also enable closer collaboration using a reliable shared understanding of product configuration possibilities, as well as greater insight into the popularity and profitability of specific configuration options. This drives better choices in the digital transformation journey with more reliable and profitable solutions that meet growing customer demands, minimize the risk of errors and get products to market faster.

Above all, CLM solutions address the major challenge of managing product complexity. They provide an efficient solution for managing all of the product configuration options over the full lifecycle of the product and across various product versions. Because a specific product configuration can be queried and validated based on real-time information, testing is faster and more reliable, ensuring customers are not sold product configurations that cannot be manufactured and delivered.



Increasing competition and customer demands leading to product complexity

Digital transformation is still a hot topic, and a top C-level agenda item, because the markets in which manufacturers operate are changing. Global competition is fierce and the margins low, which requires manufacturers to be both cost-efficient and more innovative at the same time. The large number of affordable global offerings available to customers is leading to increased demands for choice, personalization and customization, as well as shorter product lifecycles.

These trends require manufacturers to provide more product options, more variants and the ability to provide mass-customization, leading to increased product complexity that needs to be managed. It is also leading to new business models, such as servitization, where customers no longer purchase and own products, but subscribe to a service providing access to the product. This places the burden of maintaining and servicing products back on the shoulders of manufacturers, leading to an increased focus on right-first-time product quality and the complete product-lifecycle.

These trends require a transformation of how manufacturers design, produce, deliver, sell and service complex products. Multiple product versions, variants, options and combinations need to be managed throughout the lifecycle of the product from order to manufacturing. This also means that product design needs to consider all of these options, dependencies and needs, and make sure that information on complex product options is available when and where it is needed.

The availability of reliable, up-to-date product configuration information helps each departmental function perform their activities more effectively, while also establishing a basis for closer collaboration with, and timely feedback to, the PLM team. This information can also be shared with partners and vendors in the supply chain to enable greater collaboration and rapid feedback. Finally, the product configuration information can be made available to customers to provide up-to-date, reliable product ordering options, whether that is assisted by sales representatives or via eCommerce websites.

Growing product complexity challenges existing PLM systems

When ERP systems were first introduced in the 90's, it was with the ambition of providing an end-to-end IT solution for managing resource and requirements planning from design to sales. However, as we have learned, each departmental function has its own context, priorities and ways of working that are not always conducive to a unified approach.

It is therefore logical to see the evolution of PLM Systems for engineering, as well as CRM systems for marketing and sales, as they have grown in significance as independent solutions. PLM is based on deep insight into the needs of engineers and product designers, while CRM systems are designed with a marketing and sales mindset and insight into how these departments function.



These three pillars have evolved to provide insight into the three critical questions of manufacturing:

- **PLM:** What are we making?
- **ERP /MES:** How will we produce and deliver it?v
- **CRM:** To whom shall we sell and deliver it?

Achieving close integration between these three systems is important, as critical information needs to be exchanged in order to ensure an efficient workflow from product design to manufacturing to sales. But, as products become more complex in meeting growing customer demands, each system is challenged in unique ways to manage this complexity.



Modern PLM includes variant management capabilities that handle different varieties of the product and product configuration options. However, as PLM systems are designed to focus on one specific product version, and the underlying features and components that constitute that product, managing the variety and complexity of products introduces complexity and scale challenges to PLM systems themselves.

There can literally be millions of product configurations to manage even for just a single product version. If we also consider that product lifecycles are getting shorter and that customized products are becoming more common, then multiple versions of the same product could be available for sale and actively supported and serviced at the same time.

While it is possible to scale PLM systems to manage this complexity, the next challenge is to collaborate with the rest of the organization and automate the way this information is made available to the ERP /MES and CRM systems in a manner logical to these systems and their respective manufacturing and sales contexts. Not only does it need to be available, but it must also be up-to-date, reliable and immediately responsive, which further challenges PLM implementations.

To understand the challenge, we also need to look at the unique challenges faced by ERP /MES and CRM systems and what they need in terms of reliable product information from PLM systems.

Unique complexity challenges in ERP /MES and CRM systems

Customer needs and demands are becoming more sophisticated and this is not just a challenge for PLM systems.

Customization and greater product variety needs to be managed in ERP/MES systems with respect to availability of components and materials from suppliers. Products need to be produced and delivered to customers in a timely manner to meet ever more demanding customer delivery expectations, which requires just-in-time delivery of the right components and materials based on the correct manufacturing Bill of Materials (mBOM). There are also additional product pricing, logistics and manufacturing options not defined in PLM that need to be associated with each product and to be matched, updated and managed in the ERP/MES.

Marketing and selling to new customers requires access to reliable information on which product options are valid and can be sold from the growing list of product versions and product configuration options. Each option needs to be priced appropriately based on information from the ERP /MES system, including marketing campaign discounts. These are all in addition to product configuration options provided by the PLM system, and other options associated with the product that are only relevant to marketing and/or sales that need to be matched, updated and managed in the CRM.

The result is that PLM systems do not have insight into a range of product configuration options that are important for other departmental functions. It can be the case that individual options related to pricing, terms and conditions or campaigns are not relevant to the product design, but these configuration options are based on product design options and are thus dependencies that can be affected by future design iterations. It is not possible for product designers and engineers to understand the impact of seemingly small product changes without an insight into these dependencies.

The impact of this misalignment is amplified in the face of fierce global competition. With multiple choices available to customers, tolerance for mistakes is non-existent. It is no longer acceptable for sales to offer product configurations that cannot be manufactured or delivered. But customers will not wait for product configuration options to be validated and tested when competitive offerings are available. Closing the gap between the availability of reliable product configuration information and the sales event is therefore crucial.



Changing customer behavior introduces new challenges and risks

Customer buying behavior and expectations are changing. Customers now demand access to more product details, options and pricing online as part of their buying process. They welcome the availability of product variants and customization options that can be accessed during their buying research with immediate information on availability and pricing. They also want more options with respect to up-front payment, subscriptions, lease-before-buy arrangements or even full-service outsourcing based on servitization models.

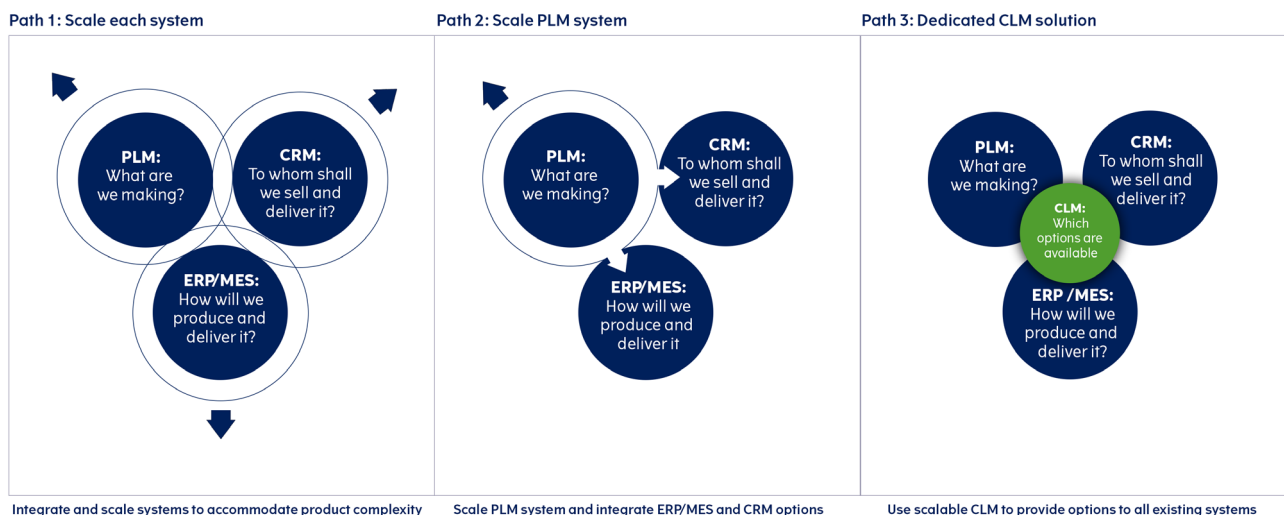
All of these demands challenge the scalability and responsiveness of ERP /MES and CRM systems to provide real-time responses with reliable information that is adapted to the specific language, region, legislation and compliance regulations without an automated process to retrieve information from the PLM system.

The greatest risk is that a specific product version or product configuration is sold to a customer without the ability to quickly confirm whether it can be produced and delivered in line with customer expectations. With millions of potential options available, the risk of selecting the wrong option based on outdated information is high unless a reliable solution is implemented.

Given the number of global options available to demanding customers, disappointing these customers by not delivering the right product or at the right time is a risk that can no longer be tolerated. So, how can we achieve closer integration between PLM systems and other IT systems so that the updated product configuration information is available when and where it is needed?

Address the complexity challenge by enhancing your PLM

ERP /MES and CRM systems need access to product configuration information for each product version, in real-time, in order to meet the growing demands of customers. This requires not just a greater integration with PLM systems, but a scalable solution so that each system can accommodate all the product options that are relevant to their specific focus. A number of integration paths can be taken:



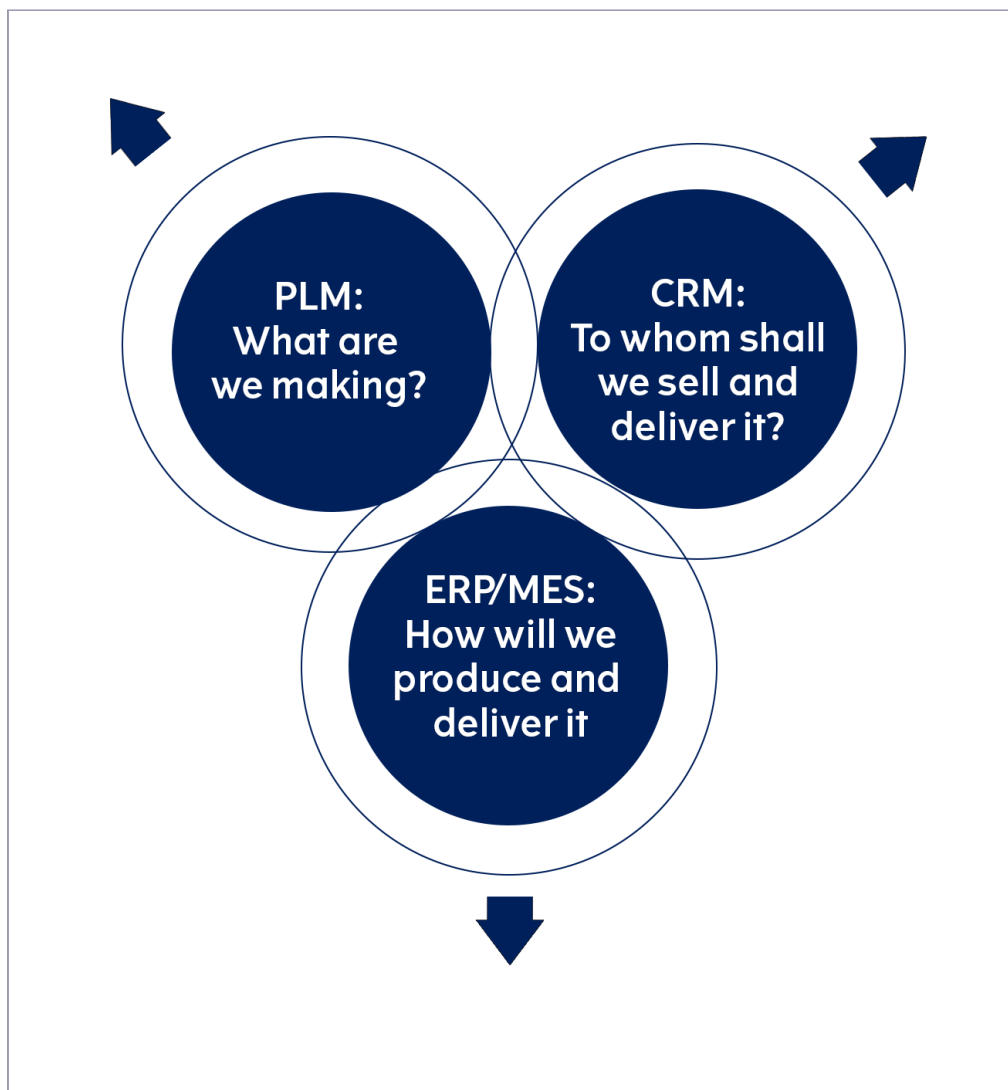
- **Path 1:** Increase the capacity of each system so that it can scale to duplicate and accommodate all of the anticipated product configuration options
- **Path 2:** Increase the capacity of the PLM system with variant management so that it can scale to accommodate all updated product configuration options and make them available to ERP /MES and CRM systems in real-time
- **Path 3:** Rely on a dedicated solution for product configuration options that can scale independently of each system and be a single-source-of-truth on product configuration for all systems

Path 1: Scale each system

Path 1 is attractive to organizations where little integration has been done between systems and enables each department to get exactly the solution that they want by importing relevant options, ignoring those that aren't, and adding those that are needed.

However, this path suffers from the drawback that data will need to be duplicated, perhaps manually, leading to delays in the availability of updated options and the potential for costly errors.

Path 1: Scale each system



Integrate and scale systems to accommodate product complexity

Path 2: Scale PLM system

Path 2 extends the capabilities of the existing PLM and is the logical home for product configuration option definition and management. It requires a sophisticated and highly scalable variant management capability that is also extremely flexible in accommodating all the manufacturing, marketing and sales options that are required.

Path 2 also requires extensive integration between systems in order to ensure that updates are automatically available to other systems. Close collaboration is required between engineering and other departments to ensure the right options are available, but conflicts can arise with respect to prioritization of implementation of options and ownership of data, as engineering effectively controls when and how updates are made.

Path 2: Scale PLM system



Scale PLM system and integrate ERP/MES and CRM options

Path 3: Dedicated CLM solution

Path 3 can be realized by implementing a Configuration Lifecycle Management (CLM) solution. CLM provides an alternative overlay approach with the advantage that very few changes are required of the existing systems or work practices in order to provide a scalable solution that can be shared across departments. The drawback of this approach is that another system needs to be introduced. However, the advantage is that CLM is a solution focused on the specific challenge of complex product configuration that is completely complementary to existing systems and work practices. CLM is designed specifically to scale and accommodate millions of product configuration options in a highly flexible manner and enables other IT systems to validate specific product configurations in real-time.

Path 3: Dedicated CLM solution



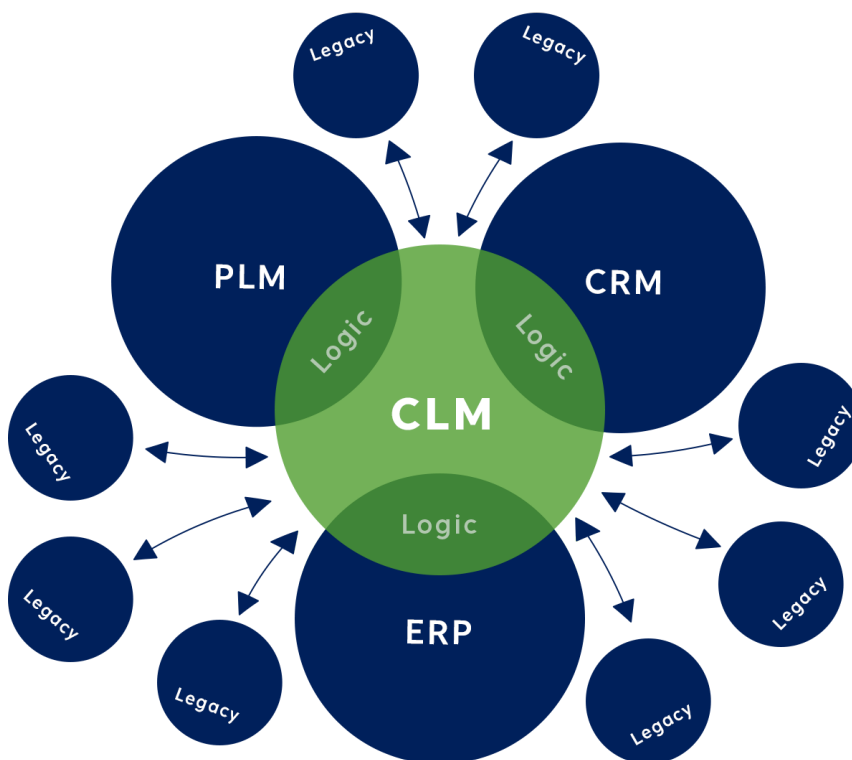
Use scalable CLM to provide options to all existing systems

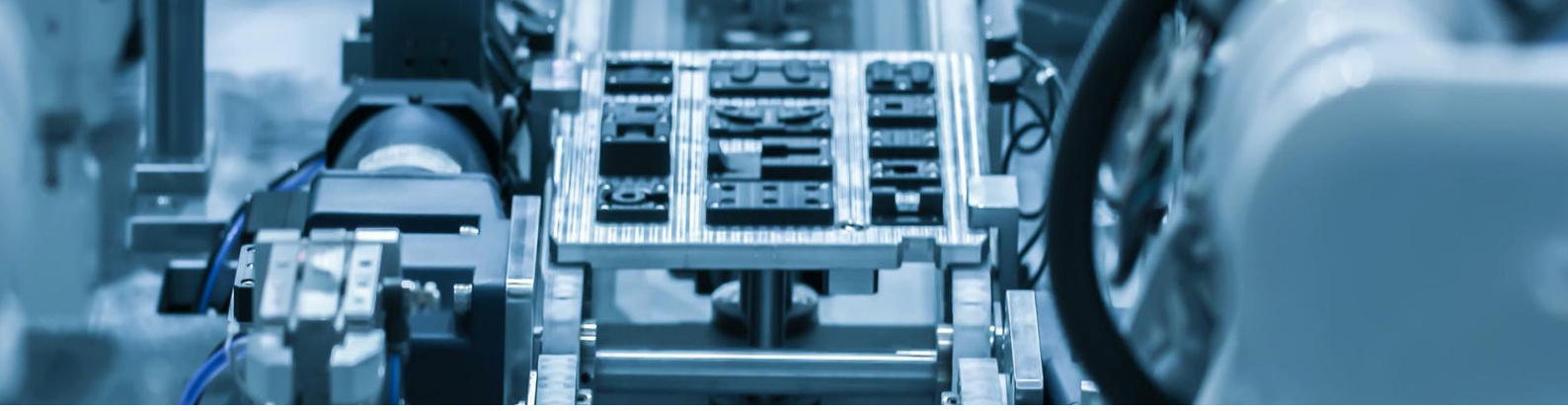
Path 3 is the shortest, most efficient and effective path to addressing complexity

While PLM systems can accommodate versioning, it can be difficult to maintain an overview of product configuration options of multiple versions over time. With a CLM system offloading the management of product configuration options, it is possible to provide an up-to-date view in real-time of millions of product configuration options across multiple product variants and versions.

This information is immediately available to ERP /MES and CRM systems and can synchronize with the additional product configuration options local to these systems. This ensures that the CLM can provide a single-source-of-truth on what is possible to produce and deliver right now.

Because it is an independent solution, ownership can be agreed upon and shared without affecting how each department conducts their daily work. By easily sharing information and experiences, CLM enables a closer collaboration that can lead to better product designs with product configuration options that are known to be popular with customers and profitable to produce.





Implement CLM with integration to PLM and enhance collaboration

Implementing CLM is not a replacement of PLM. Quite the contrary; it is an enhancement.

CLM is focused on providing an accurate and up-to-date status of valid product configuration options across multiple product variants and versions. It adds an extra dimension to PLM solutions that addresses product complexity and can be leveraged by PLM systems.

From an integration point of view, decisions on how information is exchanged between the PLM and CLM systems and, more importantly, where it resides, can depend on the capabilities of the individual PLM implementations.

For example, if the PLM has a highly sophisticated variant management solution, then the master data related to technical product configuration options can be defined and managed in the PLM and exported when changes are made to the CLM solution.

The CLM solution can then be used to add product configuration options important to manufacturing, marketing, sales and service, providing each of these departments with their own customized view relevant to their daily work. This approach has the advantage of product design and development processes and handovers to other departments remaining the same, but making it easier to share reliable product configuration information with a highly responsive solution.

Alternatively, all product configuration options can be defined and managed in the CLM solution and made available to the PLM system, in the same way that information is made available to ERP /MES and CRM systems. The advantage of this approach is that the product configuration option data can scale independently in the CLM system without requiring a similar scaling of the PLM system. This approach also enables closer collaboration with other departments in defining required product configuration options in a shared system solution.

Implement CLM to increase reliability and time-to-market

Closer collaboration means that potential issues in manufacturing, sales and service are identified and addressed earlier, dramatically reducing the cost and impact of addressing them later in the product lifecycle.

However, even without closer collaboration, the availability of product configuration information that is updated, reliable and available in real-time without delays to all departments ensures that changes and additions can be addressed immediately. It means that queries on valid product configuration options can always be relied upon to provide an up-to-date and reliable response. The manufacturing, marketing, sales and service departments can thus operate with full confidence and without delay without the risk of producing, selling or servicing products based on erroneous information.

Flexible model-based CLM solutions

CLM solutions are flexible by design and can accommodate different types of system integrations as well as product delivery processes. The CLM solution is based on an independent product configuration model that calculates all potential product configuration options and can determine immediately the validity of a specific combination of configuration options.

This calculation is based on information provided by the PLM system, as well as the ERP /MES and CRM systems, but does not require any further interaction in determining the validity of configuration options. Only changes to product configuration options due to design or availability need to be provided. This allows the CLM solution to operate and scale independently without adversely affecting existing systems.

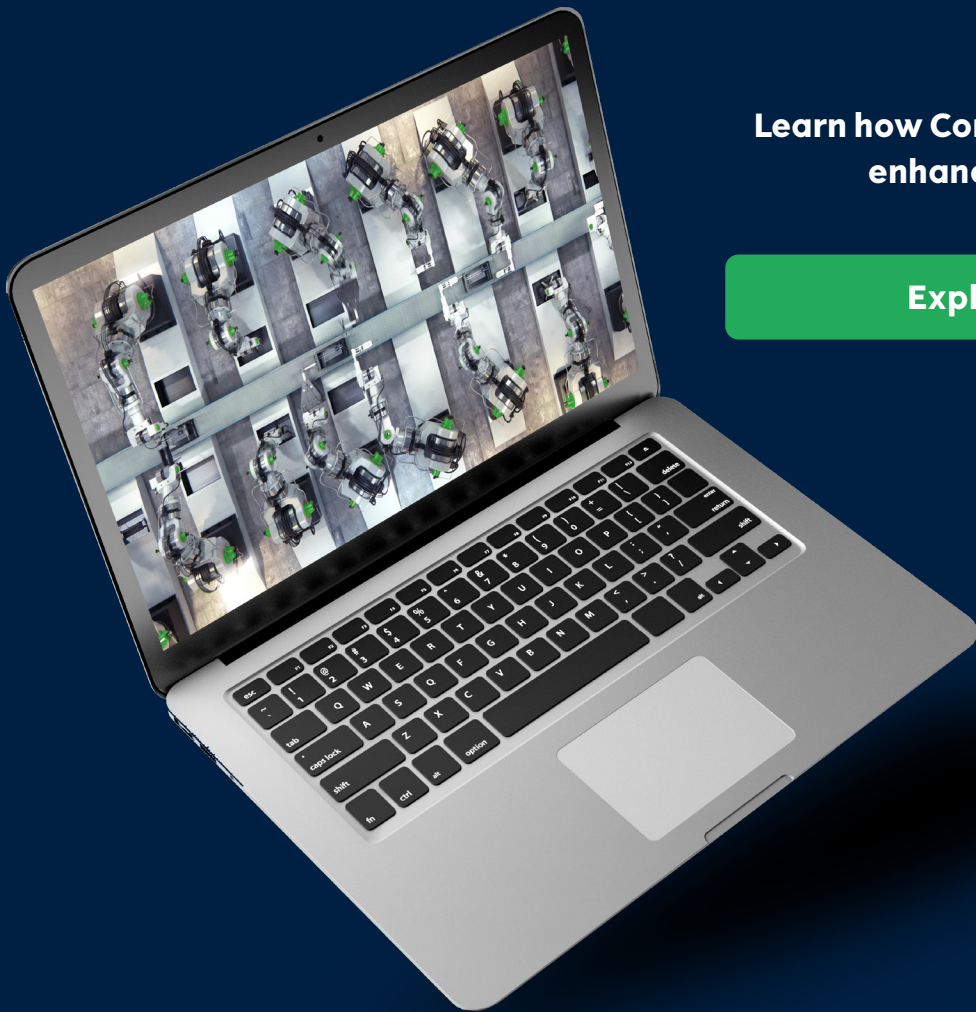
The CLM solution is also flexible in how product configuration options are presented. Not all options are relevant to all users. Specific views can be created that are relevant to each user and their role.



CLM enhances PLM solutions and enables right-first-time product design

CLM enables PLM systems to scale to meet the growing complexity of products without impacting existing system installations and processes. However, CLM also provides the basis for a closer collaboration between departments in the design of new products as it provides a single-source-of-truth on all product configuration options from production to manufacturing to sales. This provides product designers and engineers with invaluable insight into logistic, manufacturing, marketing, sales and service challenges with expert input from other functional departments as well as supply-chain partners, vendors and even customers themselves. Customer input can be seen in which options are most often chosen, and which are not, as well as data on issues that customers have encountered while selecting their desired product configuration options.

This enables a more collaborative product design process resulting in better, more profitable and effective product options with a greater probability of timely delivery and, ultimately, higher profit margins. Customers are also more satisfied as there is a lower risk of product configuration errors or lack of availability of the options they want as the CLM system will ensure that these invalid options will not be presented.



**Learn how Configit solutions can
enhance your PLM**

Explore more

At Configit, we help our customers globally to master the challenges of getting configurable products to market faster, with higher quality and engineered at lower costs. As a pioneer of Configuration Lifecycle Management (CLM), we have been instrumental in driving the adoption of CLM solutions globally. The Configit CLM solution is the first of its kind to connect and enable collaboration across functions - from engineering and sales to manufacturing and service - by ensuring the entire organization is operating from the same data. We call it a single source of truth, which provides companies with comprehensive, accurate and easily accessible data of all their configurable products.

Trusted by the world's largest manufacturing companies for their mission-critical digital transformation projects, our advanced configuration platform built on patented Virtual Tabulation® technology handles the most complex products on the market.

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