

Moving from PDM to PLM

How Volvo CE established the foundation for a digital thread

Volvo CE needed a unified product lifecycle management system to provide a product-centric information backbone for the extended enterprise

Headquartered in Gothenburg, Sweden, Volvo Construction Equipment (CE) is a leading international manufacturer of premium construction equipment. Leveraging more than 180 years of construction expertise and the knowledge of over 14,000 employees, it supplies products and services to more than 180 countries around the world. With innovation at the heart of its strategy and culture, Volvo CE provides the right machines and solutions for any construction job to ensure customer success.

Ever-changing market conditions, shorter product lifecycles, and increasing product complexity are requiring industrial organizations like Volvo CE to change. Companies are adapting by creating new business models, globalizing operations through decentralized production, and leveraging technologies like automation and connectivity to enable

customized products and smart services. To realize key business capabilities and secure long-term growth, Volvo CE set out to define a vision for digital transformation.

Like many companies with a long history, mergers and acquisitions have impacted Volvo CE's product and service portfolio. A complicated and costly IT landscape—based on no less than four different product data management (PDM) systems—emerged over the last four decades. As a consequence, a significant part of the investment capacity went to keeping the old systems running. Little or no investment could be put towards actually improving ways of working.

Volvo CE needed a unified product lifecycle management (PLM) system. They chose to leverage PTC's Windchill, a comprehensive PLM solution for data governance and traceability, providing an authoritative source of truth across engineering, operations, suppliers, and customers. By creating a digital thread and consistent product architecture, Volvo CE would enable cross-functional teams to manage hardware and software complexity in one place.

How they did it: Volvo CE leveraged PTC's out-of-the-box Value-Ready Deployment of Windchill to establish a digital thread

Approach

Implementing a unified PLM solution impacts almost every organization within Volvo CE. As such, it was critical to involve the entire company from the very beginning. To define goals and strategy in collaboration with teams across the business, the Strategy, Architecture and Systems team conducted an Acceleration Workshop. This was the first of many recurring meetings that ensured a hands-on and agile approach to change management.

The purpose of these meetings was to create "pull," which describes when people in relevant parts of the organization want something from the team leading change—in this case, a new PLM solution and more modern ways of working. By

meeting frequently and defining needs from the bottom up, the team created an "upside-down" leadership triangle in which leadership supports the goals of the frontline workers and relevant organizations.

Coming out of the Acceleration Workshop, Volvo CE had a clear vision for the PLM program: deliver methods, processes, and tools—namely Windchill—that create a central information hub for everyone associated with a given product. PLM would enable a new approach to product development and facilitate easier communication among those working on a product, driving faster time to market, higher quality, and lower costs. Teams would be able to leverage a single source of truth for any item related to their products and architectures, ensuring that all work done adds value and collective knowledge. And finally, by establishing a digital thread, Volvo CE would set the foundation for becoming a service-oriented solution provider.



Solution

After they defined their vision, the Strategy, Architecture and Systems team structured their solution around an end-to-end PLM "house." The end-to-end PLM house describes the fundamental areas of change that would comprise end-to-end product and service documentation. These included part-centric change and configuration management, product data management (with 3D multi-CAD environment integration), application lifecycle management, product variability management, multi-bill-of-material (BOM) management (engineering, manufacturing, and service BOMs), concurrent engineering, and more.

To get there, Volvo CE used Windchill's out-of-the-box Value-Ready Deployment (VRD) from PTC. The VRD of Windchill is a preconfigured, flexible configuration built upon 25 years of PLM best practices. "Value-Ready Deployment" means the solution is a proven, ready-to-deploy offering of Windchill that can be up and running within months and is fully supported by PTC experts.

Leveraging the best practices, Volvo CE streamlined their processes associated with product development toward those of the VRD's. They were able to do this quickly, as they didn't need to make any developments to the out-of-the-box solution. Windchill became the only source of truth related to their products and architectures life cycle.

Execution

As they rolled out the solution, Volvo CE followed the solution and capabilities deployment defined by the Strategy and Solution Portfolio team. The team identified capabilities that could be implemented independently and unlock value at each step based on factors like user communities targeted, competencies enabled, cost evaluation, and data availability and maturity.

Volvo CE performed deployment for both current production and new projects in phases, prioritizing them based on project impact, user availability, funding capacity, and more. Volvo CE involved key users in the development of the solution to ensure that each deployment had the capabilities each specific team needed. The integration and migration of all layers happened in phases over several months, with daily meetings between Volvo CE product teams and Windchill experts.

Delivering the system and ensuring successful change management took more than just training. Change was led by early adopters and supported by the leadership principle of "pull" from the organization. First, key users involved in the deployment helped train early adopters in the product lines. Early adopters then helped all team members become familiar with Windchill, and the solution was adopted organically into the workflows of the entire organization.



The benefits: Volvo CE focused on five areas where they could drive efficiency

The Strategy, Architecture and Systems team focused on five areas of the product development process where efficiency improvements were required. By applying PLM fundamentals to these areas, Volvo CE moved the business towards a unified PLM approach.

Design engineering

Before

Prior to Windchill, Volvo CE didn't have a common structure for product documentation in design engineering. Volvo CE had multiple design engineering systems with limited connections between them. Users manually created and compared assembly structures, even though those structures already existed in CAD.

Engineers also had to make large, time-consuming installation drawings to show how parts were assembled in the machine. In order to share parts between three PDM and three engineering bills of material (EBOM) systems, users often had to manually set up parts that already existed in another system.

After

Volvo CE implemented one common system for product data management, allowing them to unify their engineering tools—including software—and establish governance and traceability for real-time visibility of upstream and downstream data. They increased efficiency and reduced costs by removing manual work and handovers and improving re-usability. Also, cross-functional interaction between engineers in early phases helps reduce costly later-stage design changes.

Moving forward, Volvo CE will leverage one common system for PDM, with CAD and assembly structure managed in the same system. This will eliminate double entries and provide a simple way to find and share parts across the ecosystem.

Virtual development

Before

Before implementing Windchill, Volvo CE's global lifecycle process across products, sites, projects, and organizations was not as visible to all key stakeholders due to a lack of common data infrastructure, varying methods for virtual models, and no connection between configuration and visualization.

After

By establishing one global process with one common data infrastructure, Volvo CE teams can now create once and reuse in many different places. This dramatically increases efficiency and enables visible configurations. They've also improved quality with better traceability of status on the virtual verification of models and analysis through clear and correct configuration rules.



Production preparation

Before

Previously, local production adaptations had no links to EBOMs. As a result, production preparation was a manual and complex process without a visual guide. Updating work instructions was another time-consuming task.

After

Windchill enables Volvo CE to establish a connection from EBOMs to operational bills of process with fact-based feedback and visualization. By decreasing manual work throughout these processes, they've also reduced the cost of human errors and accelerated the time to industrialization. Increased interactions between designers and manufacturing engineers during development helps identify issues in early phases and ensure manufacturability and agility.

Engineering changes

Before

With disparate PDM systems, Volvo CE's configuration check process was not optimal when handling multiple changes. Product configurations were managed in Microsoft Excel, Teams, and sometimes even on paper. Because of this, it was difficult to create and update product and options configurations, including combinations and restrictions. There was no direct connection to downstream applications, and it wasn't possible to share options with technology systems such as VPM and PROST.

Furthermore, engineering change notice (ECN) analysis and preparation weren't visualized for designers or linked in the system. Change requests were handled in several systems (such

as Excel, Teams, and different databases) so there was no common way of working. Once an ECN began, engineers had to search in several systems for parts or information. Finally, they lacked visibility into what the impact of the changes would be in downstream processes, such as bills of process (BOP) and serviceability.

After

Leveraging Windchill, Volvo CE creates and collects all change management requests and problem reports in one system. By establishing a connection between parts in EBOMs, manufacturing bills of material (MBOMs), and service bills of material (SBOMs) with visualizations, engineers see the direct impact on downstream processes and execute analysis on a single source of information, greatly reducing change cycle times. With a single configurator, it's easier to connect options to a product and track their combinations. And when adding or removing an option, engineers can see the direct link with products and projects.

One single source of information and simplified connections between CAD and BOM data increases efficiency, enabling designers to quickly validate the impact of development changes on products.

Concurrent engineering

Before

Volvo CE didn't have enough consistency for the data they worked with, leading to the downstream rework of product preparation and time-consuming meetings to coordinate workstreams. Because different data was kept in different systems, Volvo CE lacked the functionality to create baselines in existing systems that could be communicated between stakeholders.



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Multiple handovers without system support led to reactive behavior and limited collaboration in early phases. Issues were often not found until late in the development process, creating rework and increasing the risk of not meeting Volvo CE's high standards for quality. A lack of visibility and cross-functional requirements handling also caused rework later in the process.

Due to a number of legacy systems, it was cumbersome for engineers to find existing parts from other PDM-communities. Many duplicates were created: around 28,000 new part numbers are introduced each year, and calculations estimated 6% of those as redundant.

After

Consistent data in one database and a single authoritative source of truth means that cross-

functional teams can collaborate on one shared system. Increased cross-functional collaboration leads to improved product and process quality, as well as the ability to reuse existing solutions and assets. This helps teams reduce costs and lead times.

Conclusion: Leveraging a single source of truth across products and architectures

By moving from PDM to PLM, Volvo CE created a single source of truth for their products and architectures life cycles. They transformed from multiple sites with different systems to all sites leveraging the same architecture.

The go-live happened quickly, with PLM systems for compact excavators, articulated haulers,

compact wheel loaders, and more happening within months. By the end of 2021, Volvo CE will have trained over 3,000 users and successfully implemented Windchill in 15 sites. They fully upgraded the first three legacy systems to Windchill and made progress toward the fourth, allowing them to start taking advantage of improvements like digital assembly and smart diagrams.

Moving forward, the PLM foundation will supercharge Volvo CE's efforts across their product offerings, production, and supply chain. For example, model-based systems engineering will enable Volvo CE to capture functional requirements and link them to simulations and product structure. With the new product architecture, Volvo CE will be able to share and re-use designs and subsystems across the entire portfolio of construction vehicles, driving faster time to market for new products. In terms of production and the supply chain, modular production enables better flexibility and scalability across global operations.

Volvo CE is now better positioned to keep unlocking benefits into the future.



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