

Seamless Integration: How ALM and PLM Work Together to Boost Quality



Using an integrated product lifecycle approach can take the guesswork out of Quality Assurance. Does your organization have what it needs to catch defects before they happen?

As software becomes more complex—and increasingly embedded in a wide range of products as well as the processes used to create them—maintaining high product quality is more challenging than ever. Many manufacturers, while accustomed to traditional product quality processes, are now adapting to address the unique demands of modern software quality. In fact, over 40% of engineers cite increasing product complexity as a top challenge, with heightened requirements and regulations following close behind¹. When quality falters, software products might experience frequent bugs or crashes, poor performance, an inconsistent UI, security vulnerabilities, and a lack of scalability—all contributing to increased rework and potential reputational damage. But when organizations consistently produce high-quality products, they

can reduce costs and increase efficiency, ultimately leading to strong customer satisfaction and a lasting competitive advantage.

Quality is a broad concept for any type of organization. Poor quality can stem from a number of different roadblocks, and once they have been identified, teams need to narrow down an effective game plan to solve them. Modern lifecycle management integrations can help organizations circumvent the costs of poor quality by taking a proactive approach to quality assurance (QA). By gauging your team's readiness for integrated lifecycle management and understanding how a unified approach can impact your operations, you can begin addressing quality mishaps before they have a chance to happen.

¹Tech-Clarity *Integrating ALM and PLM Buyer's Guide*



Finding the Root Causes of Software-Driven Product Quality

To achieve and maintain high product quality in today's fast-paced development environments, teams must go beyond awareness of potential risks and actively address the root causes. As products grow more complicated with tightly coupled hardware and software components, the risk of quality issues increases significantly. And for teams working across disconnected systems or siloed processes, maintaining control over every aspect of product development becomes even more difficult. Identifying the root causes of these challenges is critical to regaining control. Use the following questions to assess where breakdowns may be happening and determine whether a more integrated approach can help your organization improve quality and streamline development.

A lack of end-to-end traceability

Are you struggling to track requirements, changes, and defects across both hardware and software? Do communication gaps arise because your teams lack a clear view of the entire development process? Are there times when issues slip through the cracks due to limited traceability across the lifecycle?



Disjointed testing processes

Are your testing processes fragmented, with components validated separately? Do you find it difficult to catch defects that emerge from the interaction between hardware and software?



Misalignment between hardware and software development

Are your hardware and software teams working on different schedules, leading to uncoordinated changes? Do you struggle to detect defects due to a lack of cohesive testing and clear traceability?

These challenges are greatly interconnected—if your organization suffers from one, it's likely it suffers from the others, too. And solving for one doesn't necessarily make the rest go away, so it's critical to address these issues holistically. Without addressing the root causes, organizations can find themselves facing significant setbacks and falling into repetitive patterns that only compile on one another, leading to an increase in costs and a blow to overall efficiency.

Cost of Poor Quality

When product quality changes for the worse, the impacts can be far reaching. Increased rework and delays can lead to reputational damage, which can cause lost revenue in the long run. This hit to an organization's brand reputation and competitive advantage is difficult to climb back from.



Increased rework and delays

Poor quality often forces teams to spend extra time and resources fixing defects, leading to missed deadlines and higher production costs.



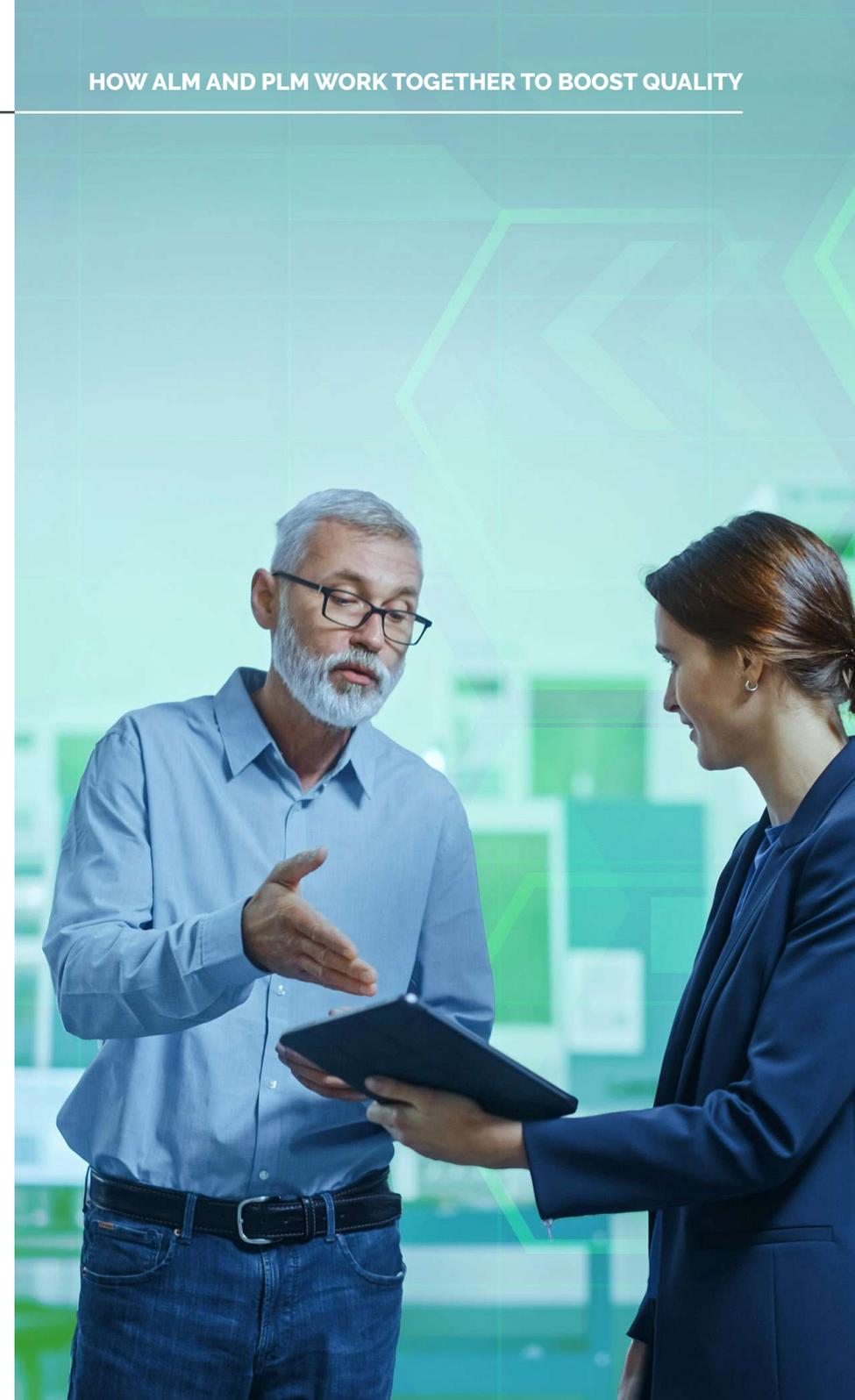
Customer dissatisfaction

When customers experience faulty products, they lose trust in the manufacturer—leading to negative feedback, returns, or even lost business.



Compliance challenges

A failure to meet stringent standards can lead to the rejection of products by regulatory bodies—opening the door for product recalls, penalties, or legal liabilities down the road.



Aligning ALM and PLM to Elevate Product Quality

It's a common misconception that ALM is only necessary when working with regulated, software-driven products, but this viewpoint overlooks the benefits it provides for organizations developing all types of complex systems. Today, products aren't just physical or digital—they're an intricate blend of both, with hardware and software working together to create a seamless user experience.

Product Lifecycle Management (PLM) tools focus on hardware development. They manage parts, models, and documents.

Application Lifecycle Management (ALM) solutions focus on streamlining software development, requirements management, and deployment processes.

Products that were once purely physical now rely on digital capabilities to meet customer needs. Cars, household appliances, and even lightbulbs are all examples of how software is becoming a key

component of traditionally hardware-centric industries, driving the need for seamless collaboration between both sides. When the digital components of these physical products are flawed, the consequences can be significant, impacting not only the product's performance but also its safety and reliability. A malfunctioning software update in a car could disable critical safety features, a glitch in a smart appliance could cause operational failures, and faulty code in a connected lightbulb could lead to erratic behavior or even electrical hazards.

Successful teams rely on both ALM and PLM to bridge the gap between hardware and software development, ensuring that all components—digital and physical—are aligned throughout the lifecycle. Using ALM and PLM together provides end-to-end visibility—from initial design through development, testing, deployment, and maintenance. Without this foundation, teams quickly lose speed and morale as they struggle to identify the location, version, and accuracy of the millions of discrete pieces of information required to orchestrate the development of today's complex products.

Realizing the Benefits of Integrated ALM and PLM

Fewer Bugs and Less Rework

Building a quality product is everyone's responsibility, not just the QA team's. Mature quality management practices empower team members to track quality throughout the product lifecycle and integrate a quality-first approach into daily activities.

Reduce the Cost of Quality

Integrations with automated testing tools speed test creation and execution across the team. Team members should be able to automatically generate test cases from requirements, create work items from failed test cases, and see at-a-glance the quality status of their individual and team workstream.

Maximize Reuse

QA efficiency climbs sharply when teams are able to parameterize test cases, organize test cases in libraries, and branch and merge libraries as needed to meet specific testing needs. The ability to version-control test assets is foundational for reuse. In mature quality assurance teams, test assets are subject to the same release, change, and configuration management discipline as any other asset.

Traceability

When teams have a continuous thread of information that links requirements, design, development, and testing across both hardware and software, it's easy to trace every change or issue throughout the product lifecycle. Teams can trace back from any defect to its source, whether in the software or hardware, ensuring that all requirements are met, and quality issues are addressed quickly. With this level of visibility, it is easier to track the status of each component, identify potential risks early on, and ensure compliance with regulatory or quality standards.

In a recent survey, nearly 70% of survey respondents reported an improvement in product quality after adopting an integrated ALM-PLM strategy.¹

¹Tech-Clarity *Integrating ALM and PLM Buyer's Guide*

Is Your Team Ready for Quality Excellence?

While the benefits of an ALM-PLM integration are far-reaching, it's important to assess how these improvements can specifically apply to your team. Pose the following questions to evaluate your current development and QA processes. This investigation will reveal where the quality gaps and opportunities are—getting you one step closer to improvements in efficiency, collaboration, and product outcomes.



Have you ever had to delay or roll back a product release due to quality issues? What was the impact of that on revenues, customer satisfaction, or reputation?

Delays or rollbacks often result in lost revenue, increased development costs, and diminished customer trust. Addressing quality issues earlier in the development process can prevent these costly setbacks.



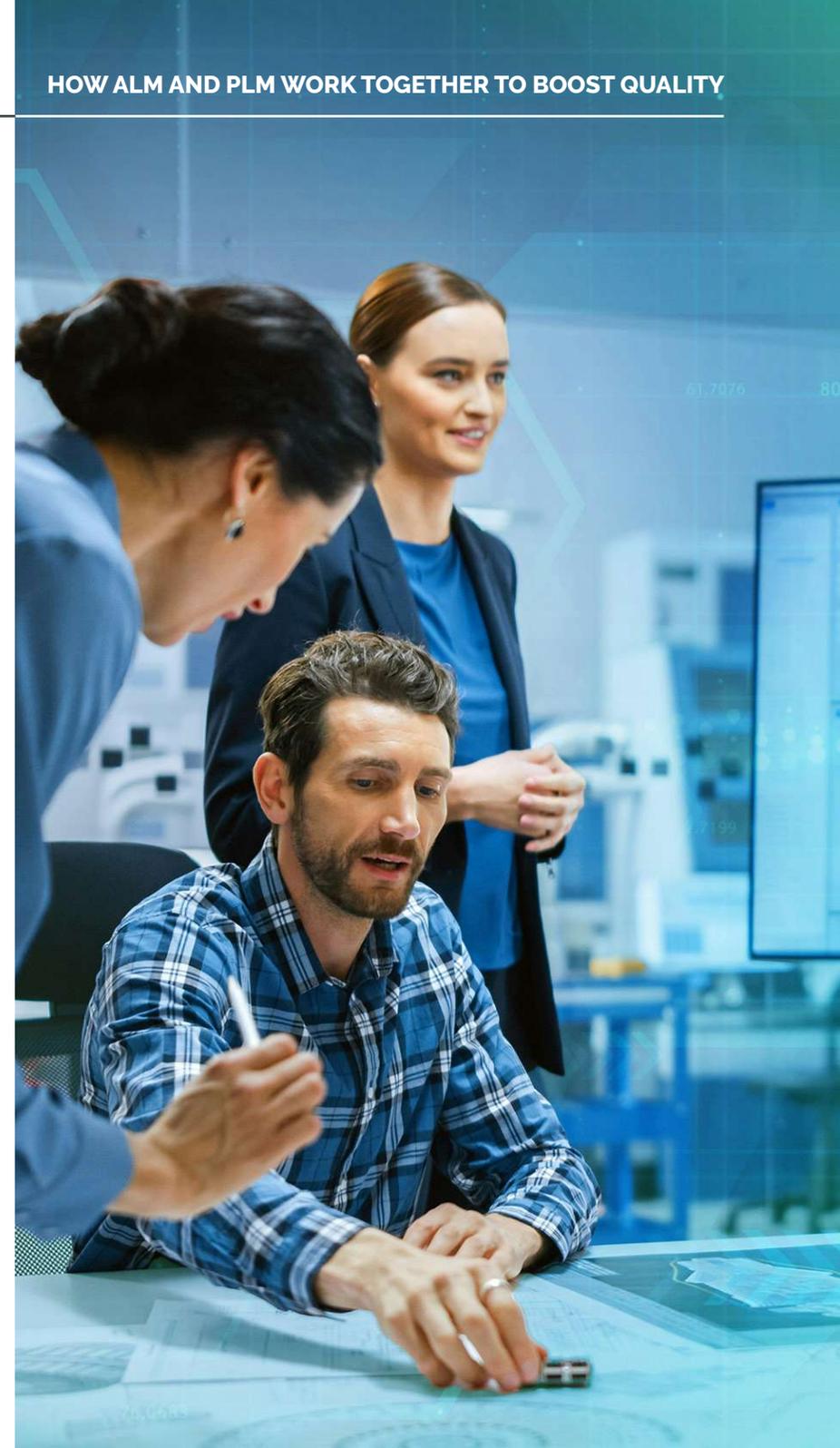
How do you know when your product is ready for release? How confident are you that all requirements have been verified and validated?

Without end-to-end traceability, it's difficult to ensure that all requirements have been met, leaving room for critical gaps throughout product development. Leveraging both ALM and PLM solutions ensures visibility into both the hardware and software development cycles, helping teams validate every aspect of the product with confidence.



How automated is your quality assurance process? How could automation help your organization improve quality, reduce quality costs, or both?

Manual processes slow down testing and increase the chance of missed defects. Automation through ALM/PLM integration can streamline quality checks, reducing human error and cutting costs associated with rework and delays.



Balance Out Your Lifecycle Management with ALM

If you already have a PLM solution in place, ALM will complete your product development process. While you're already reaping the benefits of lifecycle management for the physical aspects of your product, integrating ALM ensures that the software side is equally well-coordinated, providing complete visibility and traceability across both sides. This holistic approach not only streamlines workflows but also enhances product quality, ensuring that all requirements are met, and changes are properly managed. Ultimately, an integrated ALM and PLM solution positions your organization to innovate faster and deliver products that exceed customer expectations.

Once you have seamless synergy across hardware and software, the impacts will reach far beyond just product quality—an integration between ALM and PLM brings about a variety of use cases, from requirements management to project governance. Read the *Top Five Use Cases of ALM-PLM Integration* eBook to learn about the enterprise-wide impact of a unified approach, and understand the steps your organization can take to reap the benefits.



Integrating ALM and PLM allows you to create a digital thread across hardware and software development. To select the right solutions for integration, consider not just software capabilities, but also factors like implementation, adoption, and specific company needs. Check out Tech-Clarity's *Integrating ALM and PLM Buyer's Guide* to learn about how modern solutions can fill the gap in your digital thread to bring product innovation, engineering efficiency, faster time to market, and a major boost to product quality.





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