Tech-Clarity

Integrating ALM and PLM Buyer's Guide

Michelle Boucher, Vice President

Enabling Software-Driven Innovation

Bringing Hardware and Software Development Together

How do you accelerate the co-development of hardware and software for your products?

Today's products increasingly rely on software for innovation. Yet, development teams follow different processes and use separate tools to support the engineering and development of hardware and software. This creates silos within the development team that causes breakdowns in communication and hurts efficiency. Then, the inevitable errors and bottlenecks drive up costs.

About This Guide

By integrating Product Lifecycle Management (PLM) for hardware and Application Lifecycle Management (ALM) for software, engineering teams can overcome development silos. This will enable more efficient processes that accelerate the development of higher-quality products. This buyer's guide reveals buying criteria to select the right solutions for integrating PLM and ALM.

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Executive Summary

ALM and PLM

As fierce market competition drives companies to get to market faster with innovative products, companies need to empower their development teams to be as efficient as possible. Products continue to become increasingly complex, and software plays an ever-growing role in innovation. Silos between development teams increase the risks of problems which drive up costs and cause delays. One way to overcome these silos is to integrate ALM and PLM.
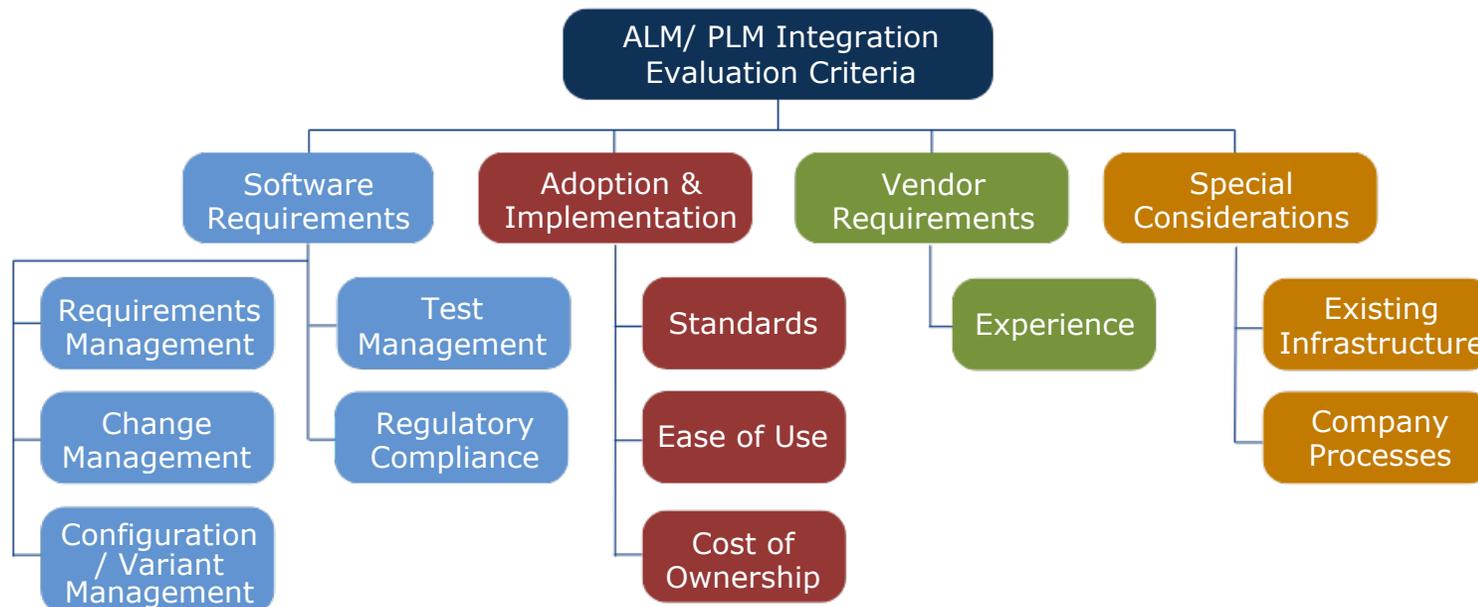
Introducing This Guide

By integrating ALM and PLM, companies will enable improved collaboration, better traceability with a digital thread, and earlier visibility into potential problems. This will result in a more efficient development process while reducing the risk of finding errors late in the process, helping to avoid delays and increased costs. This buyer's guide will help manufacturers select the right software for an integrated ALM and PLM solution.

How to Use This Guide

This guide comprises four major sections covering software tool functionality, service requirements, vendor attributes, and special company considerations. Each section includes a checklist of key requirements to support your selection process.

This guide does not focus on buyer criteria for PLM or ALM solutions, but rather criteria to support key processes that should span both systems as an integrated solution. It is not an all-encompassing requirements list, but provides a high-level overview of criteria considerations.
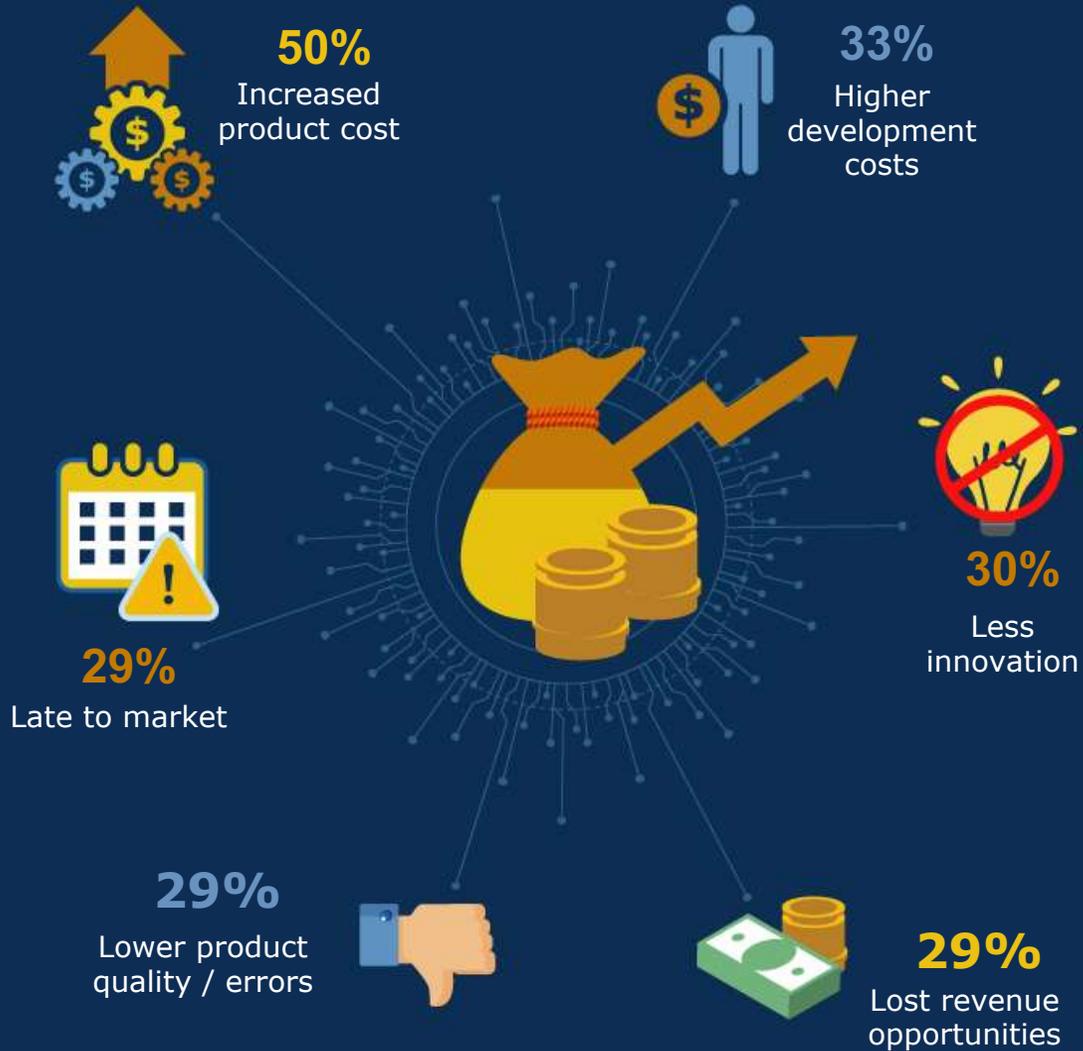
By integrating ALM and PLM, companies will enable **improved collaboration, better traceability with a digital thread, and earlier visibility into potential problems**.

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ALM/ PLM Integration Evaluation Criteria
├── Software Requirements
│   ├── Requirements Management
│   ├── Change Management
│   ├── Configuration / Variant Management
│   ├── Test Management
│   └── Regulatory Compliance
├── Adoption & Implementation
│   ├── Standards
│   ├── Ease of Use
│   └── Cost of Ownership
├── Vendor Requirements
│   └── Experience
└── Special Considerations
    ├── Existing Infrastructure
    └── Company Processes
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BUSINESS IMPACTS OF CHALLENGES

50%
Increased product cost

33%
Higher development costs

30%
Less innovation

29%
Late to market

29%
Lower product quality / errors

29%
Lost revenue opportunities

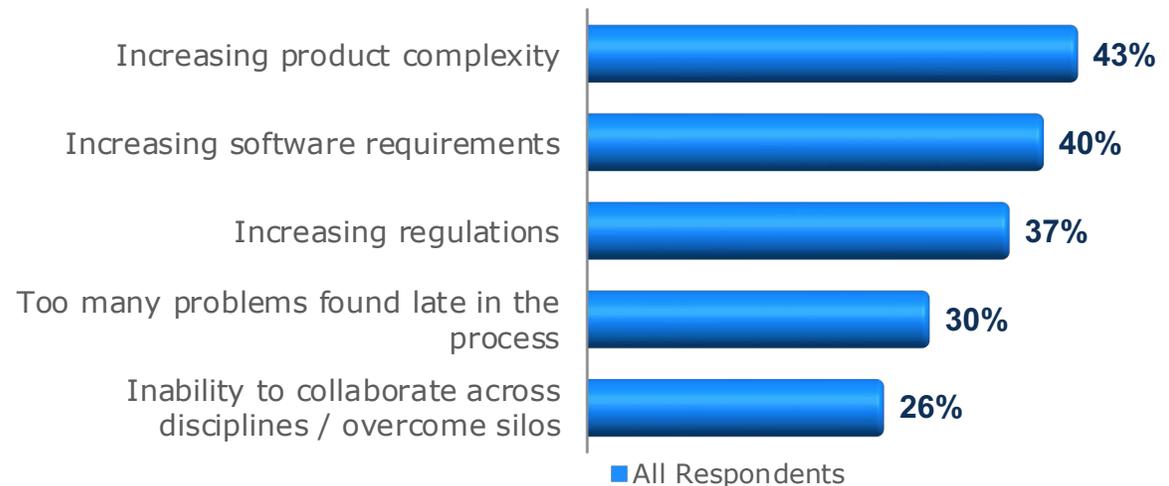** Percentages represent respondents reporting this as a top challenge*

Why Integrate?

Growing Importance of Software

Software is increasingly becoming a major source of innovation, increasing its importance in product development. Yet, despite its criticality, many companies develop it separately from the hardware. As a result, companies experience many challenges that make the jobs of engineers much harder.[1]

Business Cost

While engineers have done their best to develop processes to deal with the challenges associated with siloed development teams, the increasing complexity and growing requirements make it easy to overlook errors. These errors come at a business cost.[2] Companies can avoid this cost by adapting their development processes to support a more integrated multi-disciplinary approach.

TOP ENGINEERING CHALLENGES DESIGNING PRODUCTS WITH HARDWARE AND SOFTWARE

Challenge	All Respondents
Increasing product complexity	43%
Increasing software requirements	40%
Increasing regulations	37%
Too many problems found late in the process	30%
Inability to collaborate across disciplines / overcome silos	26%

■ All Respondents

The Value of a Digital Thread

Overcome Silos

Hardware and software follow different development methods. The rigor of hardware development has led many companies to adopt PLM to help them manage it. Meanwhile, software is developed at a much faster pace, often following the Agile Methodology. ALM solutions have been tailored to support the rapid software development process.
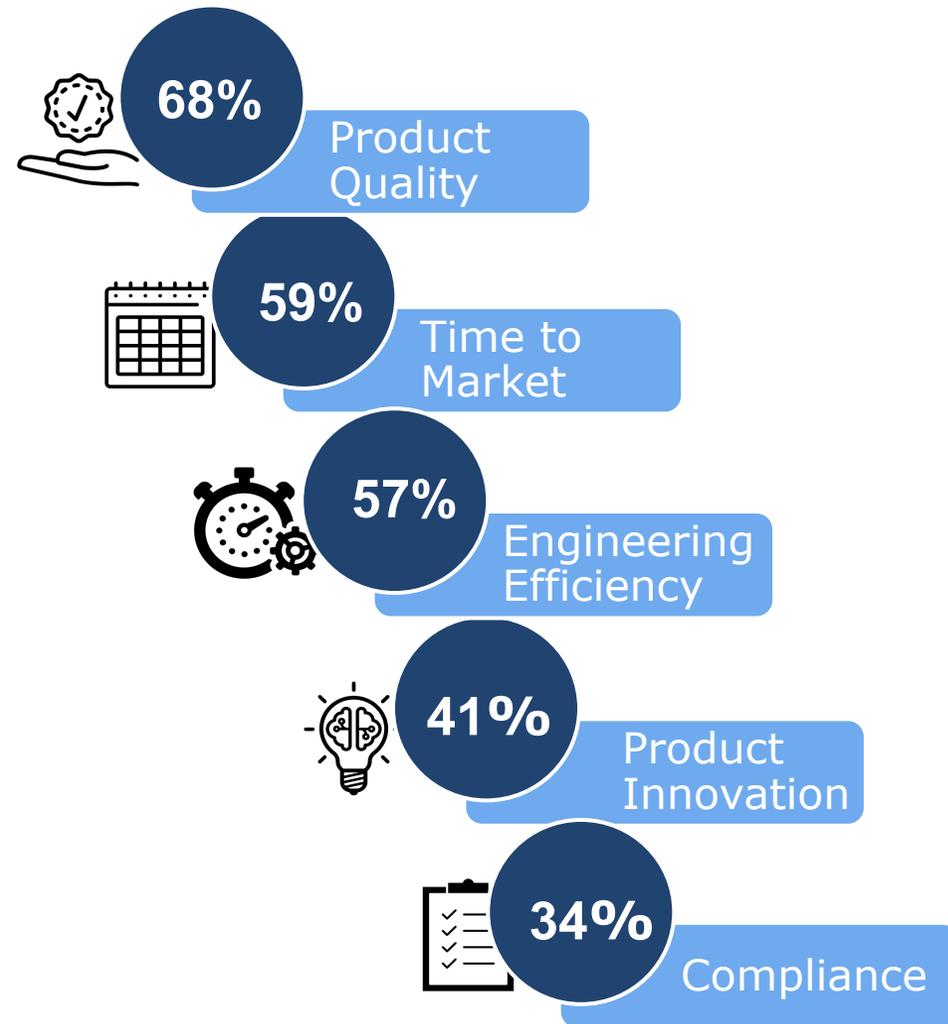
With so much innovation coming from software, software needs to iterate quickly and should not be slowed down by hardware's slower pace. However, keeping the systems separate prevents processes from being managed across disciplines, resulting in companies missing out on opportunities to improve efficiency.

Disconnected systems make it hard for engineers to find what they need. They are also unsure if they can trust data as they don't have visibility into changes that impact them. Inefficiency results in engineers wasting 33% of their time on non-value-added work.[3] This non-value-added work includes things like searching for information and recreating work. They often don't even know if they are working with the latest information.

Integrate ALM and PLM

One way to overcome this is to integrate ALM and PLM. This integration will create a digital thread across the development process, resulting in multiple business benefits (see graphic).[4]

DIGITAL THREAD BUSINESS BENEFITS

68% Product Quality

59% Time to Market

57% Engineering Efficiency

41% Product Innovation

34% Compliance

* Percentages reflect the percentage of respondents who report improvement after adopting a digital thread.

How Will Integrating ALM and PLM Help?

Assess Your Needs

To determine if your company could benefit by integrating ALM and PLM, consider the following questions:

- How much time does your team waste searching for data, evaluating changes, or redoing work due to outdated data?
- How much better would your products be if they spent that time on innovation instead?
- How much faster could you get to market if engineers could get that wasted time back?
- How much time do engineers waste due to the inability to assess the full impact of a change?
- Could your team benefit from increased reuse?
- When problems occur, how easy is it to trace them back to the source, requirement, and test case?
- Can your software processes support continuous integration (CI)/continuous delivery (CD)?
- Would automated processes for generating regulatory compliance reports help your team?

These are all ways that integrating ALM/PLM can help accelerate your product development process, resulting in higher-quality products that cost less. We will now share requirements to consider when integrating ALM and PLM.

1. Requirements Management

Establish a Foundation
Requirements define what engineers need to do and must be easy to understand. Satisfying requirements may involve mechanical components, electronics, and software, so it is important that engineers have a consolidated view of all requirements and their dependencies. They should not waste valuable time searching multiple locations to find requirements.

Traceability to the use case clarifies the requirement definition. Teams must also be able to trace artifacts or source code back to the requirement. Visibility into the requirements status helps teams understand what's been satisfied and what still needs work. It also provides management with visibility into project status.

Understanding who is working on what also improves team collaboration, which can lead to greater efficiency and opportunities to collaborate on more creative solutions. Integrating ALM and PLM can achieve this consolidated view of requirements.

The ability to reuse requirements will save time. Many companies use spreadsheets and documents to define and manage requirements, so to support adoption, the solution should be as easy to work with as their current processes.

Integration Requirements for Managing Requirements

- ✓ Central access for requirements across all disciplines
- ✓ Traceability and visibility into interdependencies across requirements, design, implementation, and test
- ✓ Requirements reuse
- ✓ Change impact analysis
- ✓ Easy to use

Integration Requirements for Managing Change

- ✓ Change impact analysis for requirements

- ✓ Change impact analysis on design artifacts and source code

- ✓ Automated change notifications

- ✓ Centralized access to change information

- ✓ Centralized release process for changed information

2. Change Management

Increase Confidence in Data

Teams need to know if they can trust their data. If requirements have changed, everyone impacted needs to know so they don't waste time working with the wrong information.

If a change impacts a component or source code, an integrated solution will extend visibility into the change. When evaluating changes, it can also be helpful to understand the downstream impacts, as the change can be implemented in a way that minimizes the impact on others. Teams must also understand how changes to a requirement will impact other parts of the design.

3. Configuration / Variant Management

Increase Reuse

Reusing existing components and code saves time since engineers are not starting from scratch. It also improves quality since they are using something that has already been verified and validated. Visibility into dependencies will also make understanding the impact of modifications to existing code and components easier. An integrated ALM and PLM solution should allow engineers to find the complete subsystem with all its dependencies.

Support for different variants will allow companies to tailor products to specific customer or regional needs. Further, connections between hardware and software will make it easier to support various configurations.

Integration Requirements for Managing Configurations/ Variants

- ✓ Modular design

- ✓ Support engineer-to-order (ETO) and configure-to-order (CTO) processes

- ✓ Identifiable reusable components and subsystems linked to their requirement/use case

- ✓ Search capabilities across systems to find reusable components

Integration Requirements for Managing Tests

✓ Test planning, definition, and authoring integrated with requirements definition

✓ Traceability between test cases and requirements

✓ Links from test cases and requirements

✓ Links from test cases to test results

4. Test Management

Support Validation and Verification Process
To ensure requirements have been met, they must be linked to a test case. An integrated ALM/PLM solution will allow engineers to validate the test based on the linked requirement, across all disciplines. This also makes it easier to ensure all requirements have a valid test case linked to them and that test cases have been defined for the right requirements. This approach will also allow regulated businesses to support compliance more easily.

5. Regulatory Compliance

Streamline Regulatory Reporting

Significant effort goes into regulatory compliance reporting. With an integrated solution, compliance reporting can be automated so that reports are automatically generated, saving significant time. Traceability will also make it easier to demonstrate compliance in the case of an audit. Should an adverse event occur, traceability will make it easier to identify test cases and implement corrective actions. Finally, templates can simplify the process of supporting regulations.

Integration Requirements to Support Regulatory Compliance

- ✓ Support for regulations such as ISO 26262, DO-178B, DO-178C, DO-254, SPICE, IEC 61508, IEC 62305, AUTOSAR, etc.
- ✓ Regulatory compliance templates
- ✓ Automated compliance reporting
- ✓ Support for regional regulations

Integration Requirements for Managing Tests

- ✓ Integration layers to enable connections across systems

- ✓ Intuitive user interface

- ✓ Support for industry standards such as OSLC and ReqIF to enable easy integration with your existing systems

- ✓ Supports a modern infrastructure for implementations

- ✓ Consider the total cost of ownership for implementation

Adoption and Implementation

Accelerate Adoption

Consider the implementation process and resources to support adoption to ensure you realize value from the integration as quickly as possible. The solution should support standards to enable easier integrations. A modern infrastructure will be more scalable and meet performance needs. Cloud solutions can offer a high level of performance while avoiding investments in additional hardware. The implementation will also be easier if you work with a vendor that supports openness and industry standards. This will simplify the integration with your existing solutions.

Vendor Considerations

Ensure a Trusted Partnership

When selecting a vendor to work with, ensure the vendor understands your business and has experience integrating ALM and PLM. A financially stable company will be around to support your business for the long term. It will also have the resources to continuously invest in and improve its products.
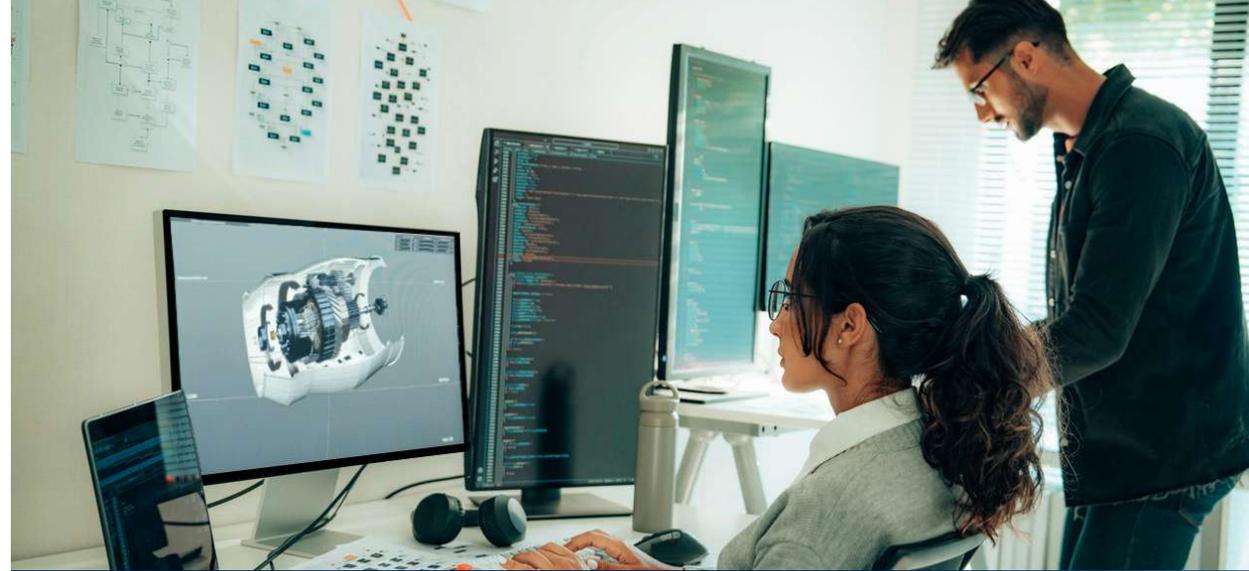
What to Look for in a Vendor

- ✔ Experience with integrating ALM/PLM

- ✔ Experience and understanding of how to lead process change

- ✔ Experience in your industry world

- ✔ Financial stability

Specific Company Needs

Consider Your Unique Needs

For a complete digital thread, you may need to integrate other databases and solutions. Consider how well the solution will support integrations with other systems.

Also, consider your company's growth plans and whether the solution can support them.

Requirements for Specific Company Needs

- ✓ Support for your process

- ✓ Integrate your company's solutions, such as ERP and CAD

- ✓ Scales for future growth

Conclusion and Next Steps

Accelerate Development

With fierce global competition, companies must accelerate their development processes without adding cost or hurting quality. Engineering teams need to be as efficient as possible, yet wasted effort often hinders the development of today's complex products. Inherent silos across engineering disciplines are often a major contributor to this wasted effort. As software continues to be a significant innovation driver, companies that empower their development teams by overcoming these silos will enjoy a competitive advantage. Integrating ALM and PLM can be a way to achieve this. By bringing these solutions together, you will create a digital thread across the hardware and software, enabling efficiencies that make it harder for competitors to compete against.

Select the Right Solutions for Your Company

Integrating ALM and PLM allows you to create a digital thread across hardware and software development. With traceability to support the management of requirements, changes, configurations, testing, and regulatory compliance, engineers will have greater confidence in their data, resulting in fewer errors, lower costs, and less wasted time. To select the right solutions to integrate ALM and PLM, consider not just software capabilities, but also factors like implementation, adoption, vendor considerations, and your specific company needs.

Acknowledgements

About the Author

Michelle Boucher is the Vice President of Research for Engineering Software for Tech-Clarity. Michelle has spent over 20 years in various roles in engineering, marketing, management, and as an analyst.

Michelle graduated magna cum laude with an MBA from Babson College and earned a BS in Mechanical Engineering, with distinction, from Worcester Polytechnic Institute. She is an experienced researcher and author, having benchmarked over 7000 product development professionals and published over 90 reports on product development best practices.

Michelle Boucher
Vice President
Tech-Clarity

Tech-Clarity.com

TechClarity.inc

@TechClarityInc

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Tech-Clarity is an independent research firm dedicated to making the business value of technology clear. We analyze how companies improve innovation, product development, design, engineering, manufacturing, and service performance through the use of digital transformation, best practices, software technology, industrial automation, and IT services.

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4. Brown, Jim. "The Seven Building Blocks of the Digital Thread," Tech-Clarity, 2021.

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