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From Design to Shop Floor: Architecting a True Digital Thread with SAP PLM, ECTR, and Visual Enterprise

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Abstract: Many organizations have yet to fully achieve digital transformation in modern manufacturing environments, where handoffs between engineering and production continue to hinder efficiency, data silos remain fragmented, and systems remain only partially integrated. This paper explains the underlying principles and practical approaches to creating a true digital thread—a unified flow of product information that begins with initial design concepts and extends through to implementation on the shop floor and beyond. It addresses key challenges, including CAD-ERP integration, the importance of engineering change management in maintaining thread integrity, and the evolving role of visual digital twins in bridging communication gaps between technical and business stakeholders. This work not only provides strategic insight into digital transformation but also offers practical guidance for organizations seeking not just to digitize, but to establish and enhance fully integrated digital threads.

Keywords: Mes, Pdm, Ebom, Mbom, Sap Erp, S/4 Hana, Plm, Cad, Sap Dms, Ectr, Ve.

INTRODUCTION

It is not an uncommon situation in many manufacturing engineering departments today: engineers struggle to locate the latest version of CAD files, manufacturing planners work with outdated BOMs, and shop floor supervisors make critical decisions based on information that is already outdated by several versions. Despite billions of dollars invested in enterprise systems, CAD platforms, and manufacturing execution systems, a major issue remains—the lack of seamless data flow between design intent and manufactured reality.

The root cause is not technical limitations but architectural fragmentation. Over the years, organizations have accumulated best-of-breed systems: Siemens NX, Creo, or SOLIDWORKS for mechanical design; Teamcenter or Windchill for product data management; SAP for ERP and manufacturing; and MES systems for production execution. While each system performs well within its domain, the gaps between them create fractures where data is lost, inconsistently handled, or fails to reach its intended destination.

What Is a Digital Thread, Exactly?

The phrase "**Digital Thread**" has become an industry buzzword, often used imprecisely. A more practical definition is as follows: a digital thread is a unified communication system that establishes a single, continuous, two-way flow of product and process information across the value chain, ensuring traceability, synchronization, and closed-loop feedback from concept to end-of-life.

Three qualities set a true digital thread apart from simple system integration:

- **Singular Source of Truth:** One logical data model accessed through different interfaces, not multiple synchronized copies.
- **Bidirectional Flow:** Manufacturing feedback informs design; field performance data guides future engineering.
- **Context Preservation:** Data retains its semantic meaning as it crosses system boundaries—a CAD assembly is understood as an assembly in ERP, not merely a flat parts list.

Organizations that have fully implemented a digital thread report a 30–40% reduction in product development time, a 25% decrease in manufacturing error rates, and a 50% improvement in change order processing. More importantly, they gain the agility to respond quickly to market changes, quality issues, and supply chain disruptions—capabilities that are difficult to achieve in traditional siloed environments [Forbes Technology Council, 2026; ManufactureNow, 2026].

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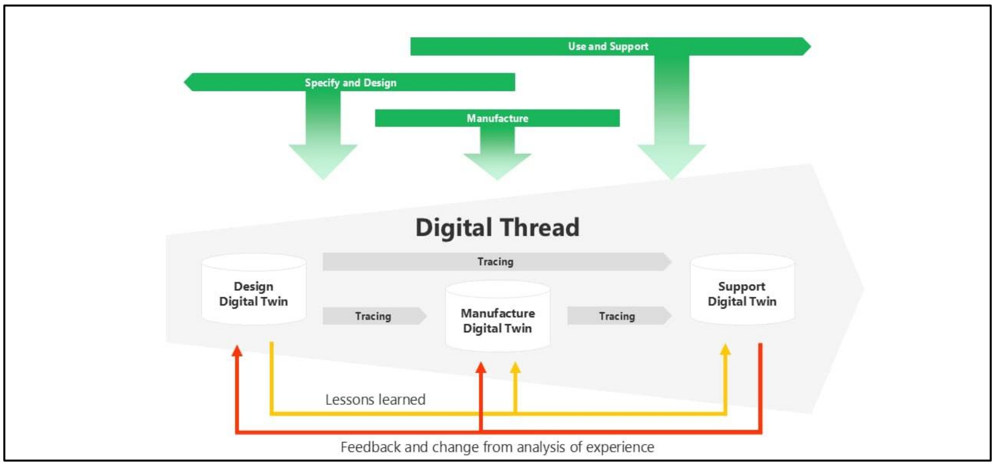

Figure 1: The Digital Thread - connecting design, manufacturing, and support via continuous data flow and feedback

WHY SAP PLM + ECTR + VISUAL ENTERPRISE?

In businesses that already use SAP as an ERP platform, the question has never been whether to adopt a digital thread architecture, but how to implement it without replacing their existing technology stack. This is where the SAP PLM ecosystem, with components such as Engineering Control Center (ECTR) and Visual Enterprise, provides a practical path forward.

SAP PLM is an enterprise-level product lifecycle management system that manages BOMs, change processes, specifications, and manufacturing documentation within a single data model, which is then utilized by production, procurement, and quality management.

SAP ECTR bridges the gap between engineering creativity and enterprise discipline. It provides engineers with a modern, user-friendly interface that feels integrated with CAD systems while connecting product data seamlessly to the authoritative structure of SAP PLM. ECTR is not merely a data translation layer; it is an integration architecture that enforces semantic relationships, preserves design intent, and allows engineers to work in their preferred tools while remaining fully integrated with enterprise operations [SAP ECTR, 2025].

SAP Visual Enterprise enhances the downstream use of product data. It transforms complex CAD assemblies into high-quality, interactive 3D visuals that are easier to access and interpret. Manufacturing engineers, service technicians, quality inspectors, and even sales teams can view product structures, assembly sequences, and components without requiring CAD licenses or specialized engineering expertise [SAP, 2026].

Together, these solutions enable what can be described as transparent PLM, where the complexity of system integration is abstracted from end users, and the digital thread operates as a seamless flow of data across a unified environment.

THE ARCHITECTURE: BUILDING BLOCKS OF THE DIGITAL THREAD

Foundation Layer: SAP S/4HANA (or SAP ECC) as the System of Record

Any discussion of digital thread architecture must begin with clarity about the system of record. In the SAP ecosystem, this is clearly SAP S/4HANA (or SAP ECC for organizations still in transition). The ERP system must serve as the authoritative source for:

- Manufacturing BOMs (MBOM) and Engineering BOMs (EBOM) in their released, production-active states.
- Material master data including procurement, costing, and planning parameters
- Orchestrate change management processes and approval workflows.
- Managing documents with SAP DMS (Document Management System)
- Production planning, execution, and quality data

Integration Layer: SAP ECTR as the Engineering Gateway

SAP ECTR addresses this integration gap through what can be described as semantic translation with context preservation [5]. Here is how it works:

Native CAD Integration: ECTR integrates with leading CAD systems (SOLIDWORKS, NX, Creo, CATIA, Inventor) through certified interfaces. Engineers continue to work within their native CAD environments, while in the background,

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metadata—such as part numbers, descriptions, revision status, and assembly structures—is continuously synchronized by ECTR with SAP PLM.

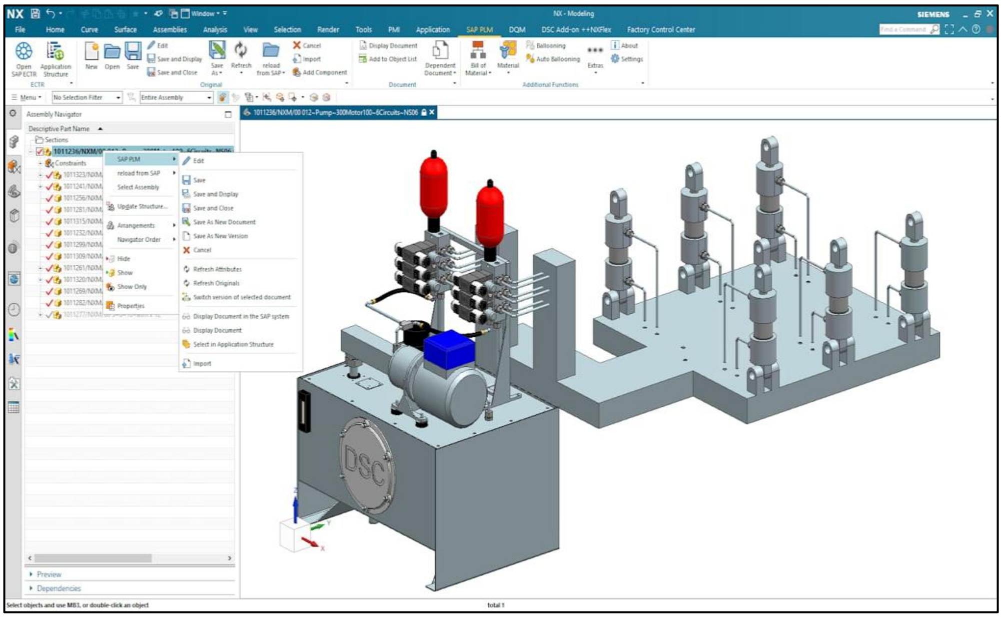

Figure 2: SAP ECTR integration with CAD systems, providing seamless connectivity between engineering tools and SAP PLM

Smart BOM Management: ECTR is based on the engineering BOM structure but supports multiple BOM views (EBOM, MBOM, service BOM), each governed by different rules. Any change made to a subassembly is automatically reflected in all impacted BOM views.

Change-Aware Functionality: ECTR does not simply transfer data; it understands the context of change. It identifies which materials have been released, tracks modifications made by engineers to part drawings, automatically generates change request placeholders, and prevents unintended changes to production BOMs.

Document and 3D Model Lifecycle: CAD files are stored in a version-controlled format within the SAP Document Management System. ECTR abstracts the complexity of DMS from engineers, allowing them to work as usual while the system manages document versioning, metadata, and links to material masters in the background.

Visualization Layer: SAP Visual Enterprise for Downstream Consumption

Although data synchronization may be seamless, a significant gap remains: many stakeholders who need access to product information cannot easily use CAD files. Manufacturing engineers need to understand assembly sequences, quality inspectors must identify defective components, service technicians require exploded views for disassembly guidance, and sales engineers need product configurations for customer interactions.

SAP Visual Enterprise addresses this challenge in several key ways:

Visual Enterprise Generator: Converts native CAD data (including complex assemblies with thousands of components) into a lightweight VDS (Visual Enterprise Data Set) format. This conversion preserves geometry, assembly structure, metadata, and even PMI (Product Manufacturing Information) annotations, while reducing file size by up to 95% compared to the original CAD files.

Visual Enterprise Author: Enables technical illustrators to create detailed visual content such as animated assembly instructions, exploded views, annotated work instructions, and interactive service procedures, all derived from engineering CAD data. Updates in the source CAD are automatically reflected in the generated content, ensuring that documentation remains accurate and up to date.

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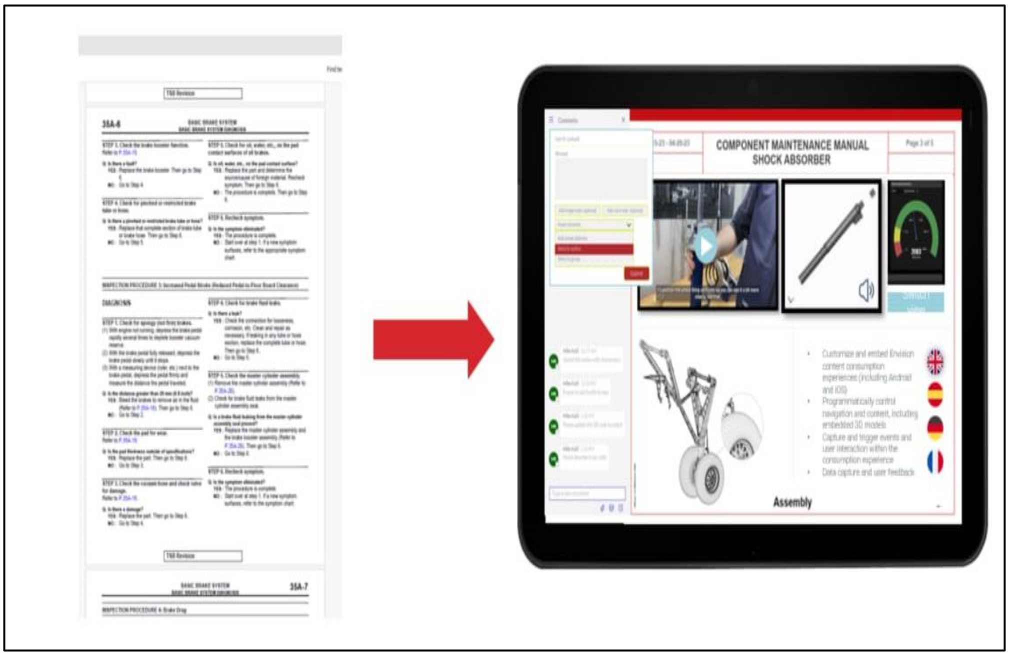

Figure 3: Transformation from paper-based work instructions to interactive 3D digital instructions on the shop floor

Visual Enterprise Viewer: It is a free, browser-based viewer that requires no installation. Access controls allow users to explore product structures, measure dimensions, retrieve related documents, and simulate assembly processes without the need for CAD tools, specialized plugins, or IT support.

This visualization layer makes the digital thread truly accessible. It is no longer limited to an engineering data structure but becomes enterprise-wide product intelligence that supports decision-making from design through to service.

Engineering Change Management: The Thread's Crucible

Companies that fail to implement effective engineering change management within the digital thread often see it deteriorate within months after go-live. This occurs because the digital thread is not a static data model; it is a dynamic system that is constantly evolving. Take into account the dynamics of a typical small or middle-level manufacturing organization.

- Engineering releases 40 to 50 new designs each month.
- 15-20 design changes are made to existing products.
- 5-8 supplier-driven changes necessitate material substitutions
- 2-3 quality issues prompt emergency change orders.

Each of these changes can impact dozens of assemblies, hundreds of documents, and thousands of dependent records across CAD, PLM, ERP, and MES systems. Without controlled change management, the digital thread quickly becomes unreliable, and trust in the data is lost.

SAP ECTR structures change management into three linked stages that move from identifying a problem to fully implementing the fix in production.

- **ECRs (problem space):** Stakeholders across departments submit well-documented change requests, and configurable workflows route them for review so only justified, approved changes move forward.
- **ECOs (solution space):** Once approved, the ECO acts as the technical container where engineers revise CAD, BOMs, and documentation, coordinate multi-disciplinary work, and keep everything in a safe draft state until final approval.
- **MCOs (implementation space):** Manufacturing then uses MCOs to control when and how approved changes reach the shop floor, managing effectivity, interchangeability, phased rollouts, and inventory so the right revision is applied to the right order at the right time.

This three-tiered approach preserves the integrity of the digital thread by maintaining a clear and traceable link from the initial issue through engineering changes to actual production

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implementation, ensuring there is no ambiguity about which revision is valid at any given moment.

Traceability as a Digital Thread Health Metric

One of the most impressive features of this architecture is complete **bidirectional traceability**. When correctly implemented, you can:

- Begin with a customer complaint and trace it back to the specific design revision, material lot, supplier batch, and manufacturing date.
- Begin with an engineering change and promptly identify all in-process work orders, inventory levels, and field units impacted.
- Start with a supplier quality issue and quickly identify all products, assemblies, and end items that use the suspect component.

This level of traceability is not merely a convenience—it is increasingly mandated in industries such as aerospace, medical devices, and automotive. More importantly, it enables manufacturing organizations to operate at digital speed without compromising quality or regulatory compliance [Forbes Technology Council, 2026].

VISUAL INTELLIGENCE: FROM DATA TO UNDERSTANDING

The Visualization Gap in Traditional PLM

Traditional PLM systems often exhibit what can be described as the data richness, information poverty paradox. They contain detailed 3D CAD models, complete BOMs, and comprehensive specifications—but access is typically limited to engineers with specialized software. The rest of the organization must rely on text-based lists, part numbers, and 2D PDFs.

This results in critical failures:

- Manufacturing engineers misinterpret assembly sequences because they rely on text instructions from CAD data they cannot see.
- Quality inspectors photograph defects but cannot precisely identify which component failed in complex assemblies.
- Field service technicians request incorrect parts because catalog descriptions do not match what they see.
- Sales engineers can't set up products for customers without frequently involving engineering resources.

The digital thread technically is present--they have the data--but it is not usable by most of the stakeholders.

Visual Enterprise as the Digital Thread Democratizer

SAP Visual Enterprise alters this dynamic by providing engineering-rich 3D information to all stakeholders.

Shop Floor Work Instructions: Operators are provided with interactive 3D animations that clearly demonstrate how assemblies fit together, reducing reliance on text-heavy instructions and 2D drawings. This leads to fewer assembly errors, as workers can better understand what they are building.

Quality Visual Inspection: Quality inspectors can mark defects directly on specific locations within the 3D model. This visual annotation is linked back through the digital thread to engineering, eliminating ambiguity about the exact component or location of the issue.

Service Visual Guidance: Field service technicians use Visual Enterprise Viewer on AR headsets or tablets. They can view animated disassembly steps, interact with 3D models to identify replacement parts, and follow guided repair procedures. As a result, first-time fix rates improve significantly, as technicians are supported with accurate, engineering-driven instructions.

Sales Visual Configuration: Sales teams can configure highly complex products in real time while customers view them in 3D, allowing full visibility of available product options. Because Visual Enterprise is connected to the digital thread, these visualizations dynamically reflect engineering-accurate BOMs, which can be directly translated into order entry.

The Digital Twin Paradigm

The capability of visual enterprises will be the key to the new concept of operational digital twins. Digital twin is not a 3D model, it is a dynamically annotated model that reflects the conditions of the real world.

- The 3D model of a production machine displays real-time parameters from IoT sensors.
- The deployed product's model shows its maintenance history, current location, and operational hours.
- The assembly line model shows real-time progress on work orders and identifies bottlenecks.

By combining Visual Enterprise visualizations with live SAP business data—such as equipment

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master records, maintenance orders, production orders, and quality notifications—organizations can create digital twins that serve as intuitive human interfaces to the digital thread. Instead of querying databases, users interact with visual representations that display real-time status overlaid on engineering-accurate geometry [TechBullion. 2026].

CHANGE MANAGEMENT REINVENTED: CLOSED-LOOP FEEDBACK ACROSS THE LIFECYCLE

This closed-loop feedback transforms change management from a one-way process into a continuous cycle of improvement.

Downstream Change Propagation

Building on the ECR/ ECO/ MCO framework described in Section 4.4, the digital thread manages systematic downstream propagation of approved changes across all affected functions.

1. Engineering creates an Engineering Change Request (ECR) in SAP PLM, identifying affected materials, BOMs, and documents
2. Cross-functional change review board evaluates impact across engineering, manufacturing, quality, service, and procurement
3. Upon approval, the Engineering Change Order (ECO) triggers automated workflows:
   - i. ECTR releases updated CAD files with new revision levels
   - ii. SAP PLM updates material master records and BOMs
   - iii. Manufacturing receives notification of impending BOM changes
   - iv. Visual Enterprise regenerates affected work instructions from updated CAD files
   - v. Procurement receives notifications about new components or obsoleted parts
   - vi. Service documentation updates for field support teams
   - vii. Quality specifications revised for changed inspection requirements
4. Effectivity management controls exactly when changes activate—by date, serial number, or production lot
5. Complete audit trail documents who approved changes, what was changed, and when changes took effect [OpenBOM, 2025; Duro Labs, 2025; Locus IT, 2025].

Upstream Feedback Mechanisms

The digital thread enables manufacturing, quality, and service domains to provide structured feedback that influences engineering decisions:

Table 1: Closed-loop feedback mechanisms from operations to engineering

Feedback Source	Engineering Impact
Manufacturing Defects	Quality management system tracks defects by root cause. Recurring design-related defects trigger engineering review and potential design modifications to improve manufacturability
Assembly Time Variance	MES captures actual assembly times versus standard. Persistent time overruns indicate design complexity issues prompting design-for-assembly improvements
Field Failure Data	Service management system tracks warranty claims and field failures. Patterns identify reliability issues driving engineering investigation and corrective design changes
Supplier Quality Issues	Supplier quality notifications link to specific material specifications. Engineering adjusts specifications, tolerances, or qualifies alternate suppliers
Continuous Improvement Suggestions	Shop floor workers submit improvement ideas. Valuable suggestions become formal ECRs with proper engineering evaluation and implementation

Predictive Change Impact Analysis

The most advanced digital thread applications leverage comprehensive data relationships to enable predictive analysis of change impacts. Building on established bidirectional traceability, predictive change impact analysis uses these interconnected data points to simulate the downstream effects of proposed changes before they are approved. This allows teams to evaluate potential operational, supply chain, and cost implications in advance. As a result, organizations can make more informed decisions and proactively mitigate risks [OpenBOM, 2025; Duro Labs, 2025].

Performance Metrics for Change Management

Organizations can establish KPIs to measure change management effectiveness within the digital thread:

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- **Change Cycle Time**: Duration from ECR initiation to full implementation across all systems
- **First-Time-Right Rate**: Percentage of changes implemented without downstream errors or rework
- **Change Impact Accuracy**: How accurately impact analysis predicted actual downstream effects
- **Emergency Change Frequency**: Frequency of expedited changes indicating possible upstream process issues
- **Change-Related Defects**: Defects attributable to change management failures or communication breakdowns

These metrics drive continuous improvement of change management processes [Tacton. 2026].

Implementation Blueprint: A Practical Roadmap for SAP-Powered Digital Thread Initiatives

Successful digital thread implementations follow structured approaches that balance technical implementation with organizational change management.

A phased roadmap minimizes risk while delivering incremental value [Locus IT, 2025].

Phase 1: Discovery and Assessment (6-8 weeks)

Current State Assessment

- Document existing systems landscape (CAD, PLM, ERP, MES)
- Map current product development and change management processes
- Identify pain points, inefficiencies, and data quality issues
- Quantify baseline metrics for subsequent ROI measurement

Stakeholder Alignment

- Engage executive sponsors from engineering, manufacturing, quality, and IT
- Define business objectives and success criteria
- Establish governance structure and decision-making authority
- Secure funding and resource commitments

Technical Architecture Design

- Define target state architecture and system interactions
- Identify integration points and data flow patterns
- Assess infrastructure requirements (servers, storage, network)
- Develop security and access control strategy

Pilot Scope Definition

- Select pilot product line or product family
- Identify pilot user communities in engineering and manufacturing
- Define pilot success criteria and measurable outcomes
- Establish pilot timeline and resource requirements

Phase 2: Foundation and Pilot Implementation (12-16 weeks)

SAP PLM Foundation

- Configure material master structure and classification
- Implement document management system and folder structure
- Configure BOM management and multi-level structures
- Establish engineering change management workflows
- Define lifecycle states and status management

ECTR Integration

- Install and configure ECTR server infrastructure
- Implement CAD system integration adapters for pilot CAD platforms
- Configure metadata mapping between CAD and SAP
- Establish file check-in/check-out workflows
- Train pilot engineering users on ECTR functionality

Visual Enterprise Foundation

- Install Visual Enterprise Generator for CAD conversion
- Implement Visual Enterprise Author for work instruction creation
- Create pilot work instructions for representative assemblies
- Configure Visual Enterprise Viewer for shop floor access
- Train manufacturing engineering on authoring workflows

Integration and Testing

- Implement integration interfaces between PLM, ECTR, and Visual Enterprise
- Configure event-driven change propagation
- Execute end-to-end testing of complete workflows
- Perform data migration for pilot product data
- Conduct user acceptance testing with pilot teams

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Phase 3: Pilot Deployment and Validation (8-12 weeks)

1. Execute pilot go-live with selected product and user communities
2. Provide onsite support during initial deployment period
3. Collect feedback from engineering and manufacturing pilot users
4. Measure pilot KPIs against baseline metrics
5. Document lessons learned and identify improvement opportunities
6. Refine processes and configurations based on pilot experience
7. Develop business case for full-scale rollout

Phase 4: Scaled Rollout (3-6 months)

Phased Expansion

- Incrementally expand to additional product lines
- Add additional CAD platforms and engineering locations
- Extend to additional manufacturing facilities
- Implement advanced capabilities (supplier collaboration, service integration)

Change Management

- Execute comprehensive training programs for all user communities
- Develop role-specific user guides and reference materials
- Establish support model (help desk, super users, centers of excellence)
- Communicate benefits and success stories to build organizational support

Continuous Improvement

- Establish regular governance reviews and KPI reporting
- Collect and prioritize enhancement requests
- Implement process improvements based on user feedback
- Stay current with SAP product updates and new capabilities
- Share best practices across product lines and facilities

Critical Success Factors

Experience across numerous implementations highlights critical success factors:

- **Executive Sponsorship**: Active engagement from senior leadership across functional boundaries
- **Cross-Functional Teams**: Implementation teams including engineering, manufacturing, quality, IT, and business process experts
- **Realistic Timelines**: Adequate time for configuration, testing, training, and organizational adoption
- **Change Management Investment**: Equal attention to people and process changes, not just technology
- **Data Migration Strategy**: Thoughtful approach to migrating legacy data vs. starting fresh
- **Integration Expertise**: Team members with deep knowledge of SAP integration technologies and patterns
- **Incremental Value Delivery**: Phased approach delivering tangible benefits early to build momentum

Looking Forward: The Digital Thread in 2026 and Beyond

By 2026, artificial intelligence will no longer be experimental but an integral component of digital thread architecture. Several applications are particularly promising [Aymax, 2026]:

Intelligent Change Impact Analysis and Predictive Quality:

AI-driven agents evaluate engineering change proposals and predict downstream effects on BOMs, work orders, inventory, and the supply chain. Tasks that previously required hours of manual analysis can now be completed in seconds with greater accuracy.

AI analyzes patterns across the digital thread—including design parameters, material properties, process data, and quality outcomes—to predict potential defects before they occur. This creates a closed feedback loop from field performance back to design improvement.

Visual AI for Inspection: Computer vision, combined with Visual Enterprise models, enables automated quality inspection. Cameras compare physical assemblies with digital twins in real time, identifying discrepancies instantly. SAP's Joule AI assistant is already demonstrating this capability through natural language interfaces that allow non-technical users to query complex digital thread data [SAP Community, 2023].

Digital Product Passports and Sustainability: Emerging regulations, particularly in the EU, require Digital Product Passports (DPPs) that track the full lifecycle of products—from raw materials to recycling. Compliance relies on a robust digital thread linking EBOM material data, supplier traceability, production and quality records, energy and carbon metrics, maintenance history, and

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Visual Enterprise disassembly guidance. Organizations with an established digital thread can leverage existing structured data, while others must rely on extensive manual data collection [Data Insights Market, 2024].

The Road to Autonomous Manufacturing: The ultimate evolution of digital thread architecture is autonomous, self-optimizing manufacturing systems. Early implementations are already emerging. Such autonomy depends on the availability of semantically rich, real-time, and reliable data across the value chain. When SAP PLM, ECTR, Visual Enterprise, ERP, and MES are fully integrated, they form the foundational data infrastructure required to enable autonomous manufacturing.

CONCLUSION

The digital thread is no longer a hypothetical concept discussed at industry conferences—it is a competitive advantage that distinguishes agile manufacturers from those struggling with fragmented data. The architecture described in this paper has been validated across multiple successful implementations in discrete manufacturing.

For organizations, the question is no longer whether to adopt a digital thread, but when and how quickly. Competitive pressures, regulatory requirements (especially digital product passports), and increasing customer expectations for customization and responsiveness are making digital thread adoption a necessity.

An often-overlooked aspect of the digital thread is its impact on people. It is not just about systems and data models—it is about enabling individuals to work more effectively. Engineers can spend less time searching for files or managing data and more time innovating. Manufacturing teams make fewer errors when they can visualize designs clearly. Service technicians resolve issues faster with accurate, visual guidance, improving customer satisfaction.

When implemented effectively, the digital thread does more than connect systems—it removes friction from human workflows. This is where its true value lies.

REFERENCES

1. Forbes Technology Council, "The digital thread: The backbone of modern manufacturing." *Forbes*. (2026).
2. ManufactureNow, "Digital thread in manufacturing: 2026 ultimate guide for seamless integration." *ManufactureNow*. (2026).
3. SAP ECTR. "SAP Engineering Control Center: Integrating engineering data into PLM software from SAP." *SAP ECTR*. (2025).
4. SAP. "3D visualization software for R&D: SAP Visual Enterprise." *SAP Products*. (2026).
5. TechBullion. "Digital threads transforming the factory floor: The intelligent factory of 2026." *TechBullion*. (2026).
6. Aymax. "What are the key SAP trends for 2026: AI, clean core, and cloud transformation." *Aymax Insights*. (2026).
7. SAP Community. "SAP Teamcenter: Connecting the enterprise with a digital thread." *SAP News*. (2023).
8. Data Insights Market. "Exploring digital thread market evolution 2026-2034: Growth catalysts and industry trends." *Data Insights Market Reports*. (2024).
9. OpenBOM. "What Is a Digital Thread in Manufacturing? Why It Matters for Modern Manufacturing Processes." (2025).
10. Duro Labs. "What Is a Digital Thread? Why it Matters for Manufacturing." (2025).
11. Locus IT. "SAP PLM with S/4HANA: Integrated Product Development & Digital Threads." (2025).
12. Tacton. "The Digital Thread in Manufacturing: Connecting Data Earlier in the Product Lifecycle." (2026).

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