

# Building the Digital Thread—Is Your Data Quality up for the Challenge?

## The Digital Thread, Data, and How to Move Beyond Documents

### Key Takeaways

The success of a digital thread in an extended enterprise heavily depends on high-quality, accurate, and consistent data to ensure it can effectively support decision-making, compliance, and operational efficiencies across diverse and dispersed organizational functions through life.

Transitioning from reliance on static, document-based data storage to dynamic, structured digital facilitates better data synchronization and accessibility and reduces the risks of data becoming outdated or misaligned with current operational realities, thereby enhancing the integrity of the digital thread.

Given the complexity of managing data across extended enterprises, there is a clear need for open data management solutions like ShareAspace that can handle the demands of large-scale, interconnected environments to build robust and effective digital threads based on the Product Lifecycle Support standard (PLCS) ISO 10303-239.

### Introduction

In the modern industrial landscape, the adoption of a “digital thread” represents a transformative approach to managing complex data throughout the product lifecycle. A digital thread is a communication framework that allows for a connected workflow and integrated view of the product’s or asset’s data throughout its lifecycle. This framework is essential for creating an integrated view that spans various stakeholders—suppliers, partners, and customers. A well-maintained digital thread fosters a seamless exchange of information, enhancing improved decision making, advanced analytics, greater efficiencies, and ultimately drives innovation.<sup>1</sup>

The challenge most organizations face is that data resides in siloed systems, often stored in unstructured formats, which quickly become outdated. This can result in costly errors, and negatively impacts operational agility, delays in decision making, and increases compliance risks. Additionally, the rapid evolution of technology and market demands necessitates swift updates that traditional document-based and unstructured document storage methods cannot support, resulting in fragmented data ecosystems

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<sup>1</sup> Research for this commentary was partially supported by Eurostep

that undermine the integrity of a digital thread. This would even pose a risk to the operating model for any modern enterprise designed to use a digital thread.

Data should be reusable and flow both downstream and upstream through continuous feedback loops. This goes beyond the applications used to establish the thread across traditionally siloed functions within an organization to include a value network of suppliers, partners, and customers. This raises the importance of both data quality and of using a standards-based approach in defining, using, and managing the digital thread across an extended enterprise. Regardless of the applications generating data, all data in a digital thread must be clear, concise, and validated.

Organizations and their extended enterprises suffer from a lack of data quality because in many cases the single authoritative source of truth for the data has not been identified and the data is not being made available where needed. Aside from disconnected data, which will quickly become out-of-sync, people will begin questioning the quality of data and will resort to manually intensive efforts to ensure they have the correct data, which is both unproductive and will result in more quality issues.

One of the common problems is structured product lifecycle data being managed in documents. This is a challenge as the data in the document does not necessarily reflect the most up-to-date product data outside the document. To ensure data quality and synchronization, structured product lifecycle data cannot exist within unstructured documents or other files, but must be exposed and transformed into a structured format.

Often, data quality errors occur during product development where the data is not correlated accurately between engineering disciplines, throughout the supply chain, and across different stages of the product lifecycle. In larger, more complex programs consisting of many partners and suppliers, there are also data quality conflict issues that occur across systems and/or boundaries between different groups.

Data required by organizations downstream are frequently controlled by a contract, where the operator has no ownership of or rights to the data. Handover, commercial agreements, etc., typically contract for a product, but either don't contract for the product information necessary to sustain the product or don't address the data quality aspects of the contracted information. The lack of data quality will manifest itself in inaccurate part numbering, classification, and other metadata errors. This results in a product structure that does not reflect the up-to-date real-world physical product, leading to inefficiencies in manufacturing and support. To compensate for lack of data quality post hand-over is both time consuming and expensive. At a minimum, this causes delays and increases the product's through-life costs. In addition to the effect that poor data quality has on engineering and manufacturing, it negatively impacts support, in-service operations, and the as-deployed operational health and product effectiveness. Furthermore, poor data quality can, in extreme cases, lead to product failure and risk the safety of the operator and/or maintainer.

If the data quality is not approaching 100%, then organizations will not trust the data and will resort to performing manual work and rework to verify the data. In scenarios like this, the organization will suffer defects and potentially degradation of brand reputation.

As we begin to adopt technologies such as Artificial Intelligence (AI) to provide useful insights and automate certain operations, companies with poor data quality will find themselves at a disadvantage. AI models trained on inaccurate data lead to flawed or misleading understandings.

## **Ensuring Data Quality in an Extended Enterprise**

Organizations are transforming by connecting their physical product world with their virtual world by using a digital thread (really a digital web) across the entire product lifecycle including the extended value

chain. CIMdata defines a digital thread as a communications framework that shares information across the design, manufacturing, and deployment of a product. It's a data-driven framework that connects different elements to provide an integrated view of an asset throughout its lifecycle. The digital thread can include information about a product's performance and use from design to production, sale, use, and disposal or recycling. This information can provide insights into how customers use products, how they perform, and how they could be improved.

A major challenge is making sure the product information is accurate and complete across the product lifecycle. The integrity of the information is directly linked to the effectiveness of the organization. The integrity of the information is based on the accuracy and completeness of the information used to make decisions. The higher the integrity, the quicker and more accurately an organization can respond as seen in Figure 1.

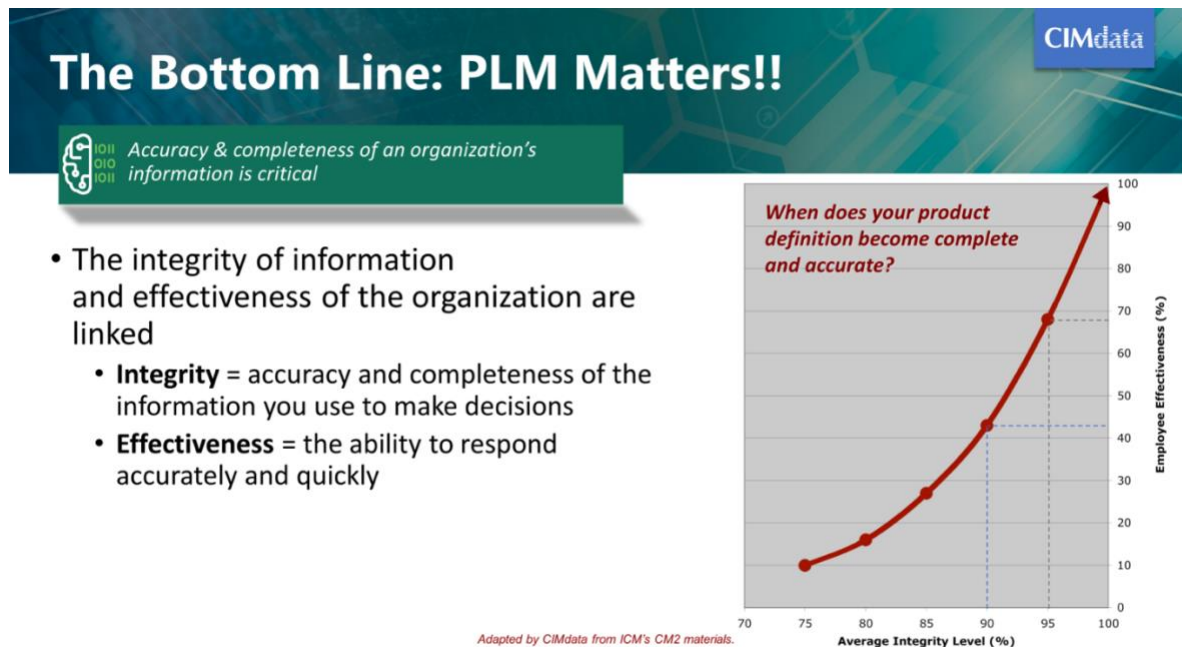


Figure 1—Data Integrity Impacts Engineering Efficiency

The consolidation of product lifecycle data from many sources in an extended enterprise exposes poor quality and lack of synchronization. To ensure data quality requires consolidation from multiple sources (i.e., data warehouses, PLM, etc.) so the data is examined, reconciled with the authoritative version, and corrected. This can be complemented by data and security governance, which will protect the owner and the correct source, ensuring rightful access to the data. Cross-disciplinary data should be correlated not only within engineering, but also across the supply chain and throughout all phases of the product lifecycle (i.e., engineering, maintenance, operations). The same is true across systems and/or boundaries between groups with different responsibilities that share interfaces and data.

Data, as it transforms to and from many sources inside or outside a company's boundary must be accurate, coherent, and valid, as it is the only way to achieve a sustainable digital thread. This must be done through data consolidation to confirm and rectify data quality issues.

Oftentimes, organizations are contractually obligated to share data using broad standards such as ISO 10303-242, which leaves room for misinterpretation. Contracts should be more specific regarding the information to be transferred during handover, to prevent costly data quality issues from flowing downstream. Ideally, reference data with KPIs that need to be adhered to should be built into the contract. A simple example would be to include CAGE codes on all part numbers.

## Data Quality Lost in Documents

To ensure data quality and synchronization with the most up-to-date information, structured data cannot be mastered in unstructured documents and files but must be transformed into a structured format. Structured product lifecycle data left in unstructured documents leads to discrepancies when the same data is updated outside the document.

By consolidating data in an open, flexible data model, data quality organizations can avoid vendor lock-in. Issues can be addressed post-handover, thereby eliminating delays, and improving a product's cost through-life.

## ShareAspace: Consolidating Data for Enhanced Quality and Integrity

Eurostep's ShareAspace addresses the pressing challenges of data integration and quality within the digital thread. ShareAspace standards-based digital collaborative platform is based on ISO standards such as ISO 10303-239 (PLCS) and ISO 10303-242 that support a digital thread across the extended lifecycle. ShareAspace excels in consolidating data from disparate sources into a centralized, structured format. This approach eradicates the common problems associated with siloed information systems, enabling a seamless flow of information that ensures all data elements are synchronized and up-to-date. The resulting continuous digital thread spans the entire value chain, enhancing visibility and control over data processes.

ShareAspace helps organizations move beyond using unstructured documents to becoming data centric. They do this with file-based exchange, controlled document sharing, and contextualized document sharing.

ShareAspace enhances data quality and integrity because it enables organizations to discover data discrepancies. The platform consolidates data from multiple sources with an ability to index unstructured documents and extract data from them into a structured data resource that can then remain synchronized across the product lifecycle. Scraping of documents extracts product data from a document and creates data items, e.g., extracts items and creates explicit relationships between the documents and items. Indexing then enables searching of the content of the document (e.g., find all documents that reference a part or find all documents that have a classification of "secret").

Further enhancing data quality and integrity, ShareAspace's powerful data management features are pivotal. The platform not only indexes and structures unstructured data but also rigorously validates this data against established standards to ensure its accuracy and completeness. Such stringent data management significantly mitigates the risks of errors and inconsistencies, thereby reducing operational inefficiencies and compliance issues. Moreover, by fostering collaboration across various departments and external partners, ShareAspace ensures that sensitive information is protected while remaining accessible to all authorized stakeholders. This elevated level of accessibility supports a more integrated and collaborative approach to product development, manufacturing, and maintenance, breaking down barriers that typically isolate data and impede workflow efficiency.

ShareAspace enables a digital thread—a communication framework that supports the connected data flow across the product's lifecycle from concept through-life with full traceability. A digital thread spans to and from many siloed functional viewpoints that can be both inside an organization's boundary or across the extended value chain.

To maintain a digital thread, effective data governance and security are paramount to the integrity and trustworthiness of the data. This ensures a seamless flow across up-to-date items and safeguards against misuses of critical information. When done correctly, it enables an organization to collaborate securely with assured data based on their PLCS architecture as shown in Figure 2.

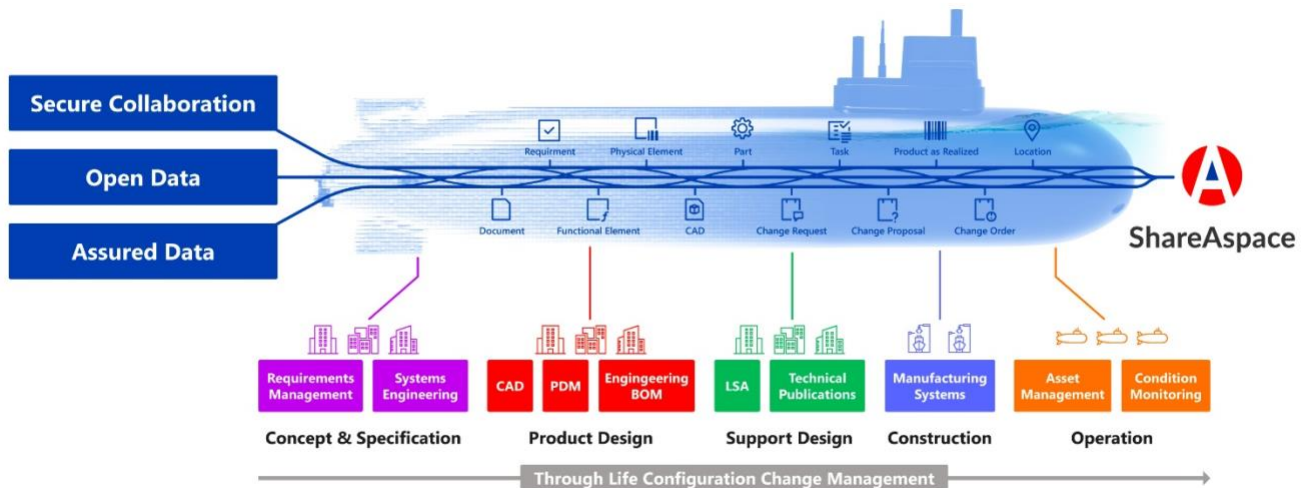


Figure 2—Digital Thread through Controlled Data

ShareAspace enables data to be consolidated, corrected, and synchronized, ensuring it is accurate, coherent, and valid across a digital thread. What differentiates the ShareAspace platform is its ability to integrate multiple sources using a plurality of technologies (i.e., editing tools, team data management tools, etc.) in multiple companies with a comprehensive, flexible data model and digital thread built on open standards.

ShareAspace’s open standards-based platform accommodates these changes, ensuring that data management practices remain robust and continue to support innovation and continuous improvement in product development and lifecycle management. Over time, the efficiencies gained lead to lower operational costs from reduced manual efforts, fewer BOM errors, and optimized resource allocation.

## Conclusion

The importance of a reliable digital thread cannot be overstated. CIMdata believes that an enterprise digital thread must be based on a high degree of data quality. Organizations should strive to reach 100% data quality, which reduces the manual efforts necessary to find and correct data, reduces defects, and improves product costs through-life. To ensure data quality and synchronization with the most up-to-date information, structured data cannot exist in unstructured documents. Unstructured product data must be transformed into a structured format. CIMdata is impressed with Eurostep’s ability to index unstructured data, which can then be used as part of the digital thread.

By consolidating data from multiple sources with ShareAspace assures rightful access to the information and protects the intellectual property of the supply chain. ShareAspace enables data to be consolidated, corrected, and synchronized, thereby ensuring the data is accurate, coherent, and valid across a digital thread to support through-life traceability.

The ShareAspace platform integrates multiple data sources from a wide array of heterogeneous technologies across multiple companies with a comprehensive, flexible data model, and a thread built on open standards. CIMdata encourages organizations with a large complex supply chain or an internally

complex organization that need to improve their data quality, to consider evaluating Eurostep's ShareAspace.

## About CIMdata

CIMdata, a global strategic management consulting firm, provides services designed to maximize an enterprise's ability to design, deliver, and support innovative products and services. For more than forty years, CIMdata has provided industrial organizations, providers of digital technologies and services, and investment firms with world-class insight, expertise, and best-practice methods on a broad set of product lifecycle management (PLM) topics and the digital transformation they enable. CIMdata also offers research, subscription services, publications, and education through certificate programs and international conferences. To learn more, visit [www.CIMdata.com](http://www.CIMdata.com) or email [info@CIMdata.com](mailto:info@CIMdata.com).