

Transforming Product Design and Energizing Innovation with Digital PLM

Five guiding principles for leveraging full-lifecycle product data across the product ecosystem.

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A new approach to PLM



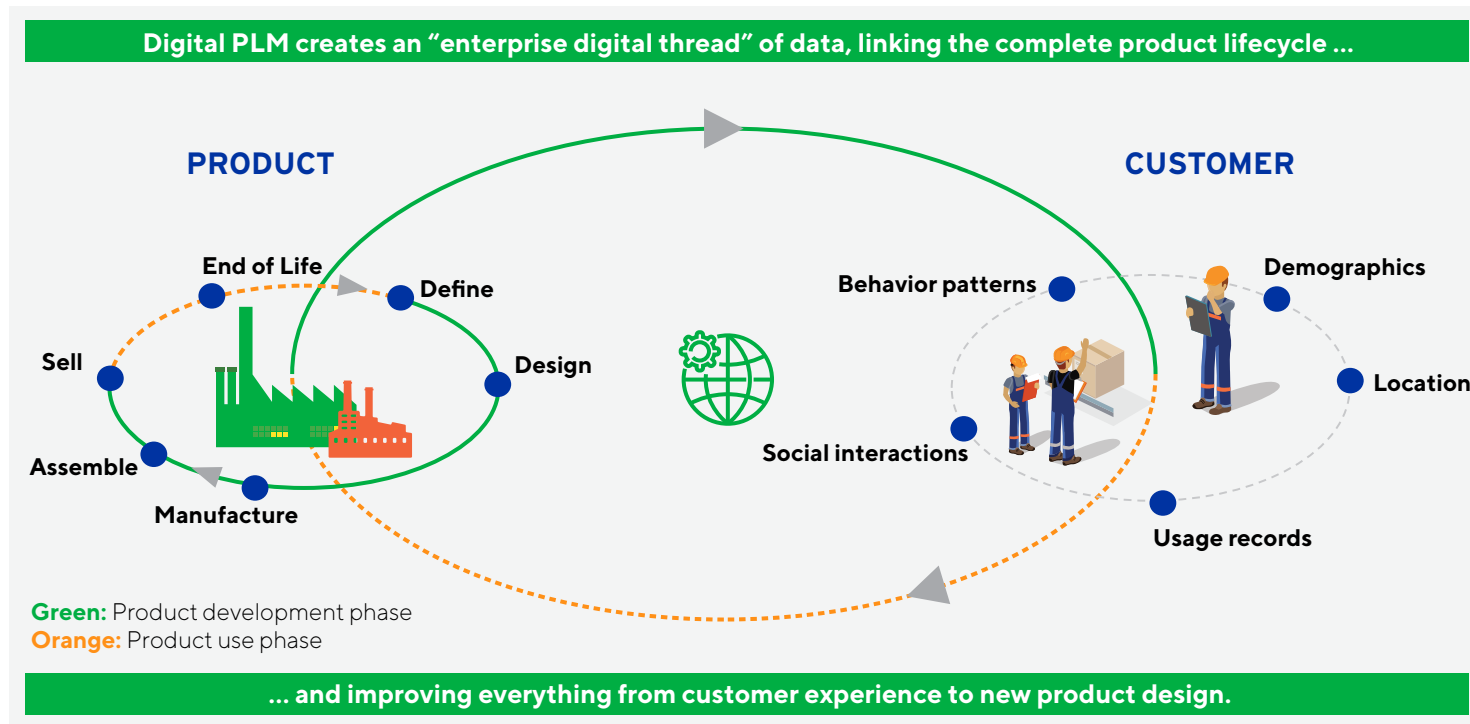
The solution

Digital product lifecycle management (PLM) captures data from the entire product lifecycle, from customers as well as partners, including suppliers of parts, consumables and services, to provide a far more complete view of how a product is used and creates value.

Businesses benefit from more accurate and timely data about not only the design-to-manufacture phases of the product, but also the “acquire,” “consume” and “discard” phases when the customer owns the product – a point at which manufacturers historically have had only partial or delayed information. In the pre-digital world,

manufacturers could only update their products at fixed intervals based on static, anecdotal or incomplete data, such as customer surveys and feedback from dealers or distributors. Today, more intelligent and connected devices allow real-time, agile and comprehensive analysis of customer behavior, usage patterns and social

connectedness, from product launch through to its disposal, recycling or reuse. This allows for “closed-loop” product development, in which real-time feedback about customer needs and preferences is designed into the next version of a product to increase its success.



With the resulting insights, manufacturers can make better decisions in the next phase of product design, provide superior service, enhance products and speed innovation. Using PLM data to prove the when, where and how products were created (such as for Fair Trade coffee) is the new frontier to gaining trust and building brands.

“Design is concerned with how things work, how they are controlled, and the nature of the interaction between people and technology. When done well, the results are brilliant, pleasurable products.”

> Don Norman, *The Design of Everyday Things*

No ordinary bottle



Today, more intelligent and connected devices allow real-time, agile and comprehensive analysis of customer behavior, usage patterns and social connectedness, from product launch through to its disposal, recycling or reuse.

Five guiding principles for digital PLM



1. Refresh enterprise product data strategy

What it means: Transform splintered, siloed product data into holistic insights usable by everyone from R&D to support, manufacturing and legal business functions.

Why it's important: Sharing information throughout the ecosystem creates a real-time, easily usable closed loop of insights gained from field performance, customers and engineering to drive next-generation product strategy. It also enables decision makers to spend more time analyzing data vs. looking for it.

How it's accomplished: Businesses need to articulate how product data is created and can be used by internal and external stakeholders, and then build a unified information flow that establishes the PLM system as the central repository of all PLM data and the driver of all product development decisions. Organizations also need to tailor data structures, delivery mechanisms and the user interface to the needs of PLM users, while reducing management overhead and maximizing operational agility and flexibility.

One approach is to move product data from an existing PLM system into a new "big data PLM" database that maintains the PLM hierarchical data structure and relationships model and also provides near-real-time information, on demand, to all stakeholders in a product data as a service (PDaaS) model.

Traditional reporting environment



Product data as a service




2. Establish digital capabilities

What it means: Build, acquire or partner to gather the people, processes, technologies and skills needed to acquire, analyze and leverage more comprehensive product data.

Why it's important: Leveraging PLM in a digital context requires capturing every piece of data received after deploying and managing IoT sensors, translating this data into meaningful information via big data analytics, breaking organizational barriers that inhibit information sharing, and working with new and different stakeholders in new ways.

How it's accomplished: Businesses can begin by assessing their skill and capability gaps and creating a roadmap to fill them. Mechanisms can include everything from centers of excellence to continuous learning platforms, internal training and partnerships with service providers. The focus should be on developing key PLM skills and training the existing workforce on capabilities around cloud, big data, business analytics and artificial intelligence.



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3. Generate business value from informed decisions

What it means: Turn raw data into informed decisions by analyzing multiple scenarios and understanding how multiple factors – such as markets, customer segments, price points and features – affect each other.

Why it's important: A product may appear to fail because it has the wrong set of features, poor quality, inadequate performance or poor pricing. But each of these defects is the result of a bad decision made by someone using available data and applying his or her own perception of its effect on the business.

By analyzing data from sensors embedded within products, captured on-demand and in real-time, using modern platforms such as cloud, businesses can enable:

- Instant feedback to research and development and design on the features, price points and designs customers want most.
- Greater confidence in decisions and more precise estimates of value because these are based on comprehensive, real-time data.
- Less rework to product design and last-minute changes due to incomplete or improper decisions.
- The ability to help product ecosystem partners, such as component suppliers and service providers, improve their offerings and (by extension) the business's.

How it's accomplished: It's essential to speed the analytics process to reduce the time it takes to find, collect, analyze and present usable data to marketers and product designers. Businesses also need to extend data collection beyond the



design-to-manufacture phase to the consumption phase, such as data about product reliability, consumer usage and social media reviews.

Making better decisions based on product data: computer disk drives

Product data	Decisions enabled
Mean time to failure	Should we continue using this drive and vendor in future products? How should we adjust warranty terms? At what point do we issue a recall? How can we monetize the data, such as selling defect data to the supplier so it can improve future design.
Percent of capacity used	Should we offer larger or smaller drives in the future, and at what price points?
Read/write performance over time	Do we need to update our firmware, drivers and storage management utilities? If so, which problems are most critical to solve? Can we sell replacement drives to customers as the originals slow down?
How often users update drivers and firmware	Are there better ways to tell customers about such updates and their value? Do we need to make our update utilities easier to use?
Timing for hard drive replacement in various computer models	Should we offer consumers replacement hard drives based on this data? If so, what capacity and performance do they value most, and how much are they willing to pay?



4. Connect stakeholders

What it means: Share data from all stages of the product lifecycle with ecosystem partners to enable value-generating services, ranging from maintenance to supply to selling data on usage and maintenance.

Why it's important: Product data is most valuable when it's shared and acted on. It allows manufacturers, for example, to move beyond rigid, long-term contracts with suppliers to flexible, on-demand relationships with producers of specialized components and/or just-in-time manufacturing to meet demand surges.

Manufacturers and their business partners today need easier, faster access to quality data to respond to fast-changing market needs with ever-greater levels of flexibility, agility and speed. Such data is also essential to meeting emerging customer demands for digital product memory, such as sourcing, manufacturing and shipment origin and history.

How it's accomplished: Businesses need to rethink which stakeholders could add value to their products and services, identify the gaps required to make these connections, and create a plan to fill those gaps. One idea is to consider the use of distributed ledger technology (the engine of blockchain networks) to allow new stakeholders to securely communicate and



complete transactions. Businesses can also use digital product labs to provide spaces for co-creation and for stakeholders to build powerful customer behavior models to uncover business

opportunities. They can also tap marketplace and lab concepts developed by PLM vendors that allow stakeholders to not only create new products but also enhance service lifecycles.



Manufacturers and their business partners today need easier, faster access to quality data.

Product ecosystem: drug infuser

Ecosystem member	Available data	Business uses of the data
Manufacturer	Frequency of use, mean time between failure, repair and software update records, error codes (real and false alarms) performance of individual components.	Understand product reliability and performance and all components within it. Refine design of future products. Hold components vendors accountable for defects in their products.
Customer (hospital or healthcare facility)	Frequency of use, mean time between failure, repair and software update records, error codes, amount and type of medication dispensed.	Track total cost of ownership for the device vs. revenue from its use. Evaluate device performance from multiple vendors to guide future product choices. Compare treatment histories with medical outcomes to improve care.
Parts supplier (pumps, monitors, valves, chips, control software)	Which components were used in which devices, and their performance and problem histories.	Improve design of future components. Track warranty/repair costs. Prove proper operation of the component to avoid liability. Prove component performance to drive sales to other manufacturers.
Consumables supplier (drugs, medication or other treatment dispensed by the product; hoses, needles, cleaning agents needed for each use)	Which supplies were used by which device and when.	Better understand usage patterns to guide future design. Work with consumables vendors to make their products easier to use with the infuser design. Possible just-in-time delivery of consumables based on usage history to minimize hospital inventory costs.
Service provider (performs ongoing calibration, preventive maintenance, repair, training)	How often repair or preventive maintenance was needed, and what kind; which product features were easiest/hardest for care givers to use.	Provide product usage insights to manufacturer for a fee or to gain preferred partner status and end-customer referrals. Optimize service scheduling and pricing. Improve training curriculum.
Medical insurer	What services were provided by the device, to whom, how often, for what conditions and treatment outcomes.	Refine policies to ensure coverage is available for treatments that provide the best outcomes. Specify use of infusers that provide the most accurate and effective treatment.
Prescriber (determines when and how the device is used and what dosage of which treatments should be administered)	What services were provided by the device, to whom, how often, for what conditions and treatment outcomes.	Refine policies to ensure coverage is available for treatments that provide the best outcomes. Specify use of infusers that provide the most accurate and effective treatment.
User (nurses and others who configure the settings on the device, add the proper medication and begin and end treatment for patients)	Whether treatment was administered successfully, the caregiver responsible, actual flow rates vs. those prescribed, error codes.	Monitor quality of patient care. Identify requirements for device maintenance or caregiver training.



5. Embrace scale

What it is: Maximize revenue, profits and market share with global rollout and multi-site implementations.

Why it's important: Digital makes it more possible, and more essential, to tackle global markets with world-class 24x7 service while capturing customer needs and sharing ideas with global teams. Approaching PLM from a digital perspective helps

companies access and analyze information about how customers use their products more quickly and easily than ever before, and to produce local variants more quickly, possibly even contextualized to personalized needs.

How it's accomplished: Businesses need to standardize as much of the product design as possible, using a team of global customer-

centric ambassadors that ensures just enough customization is done to meet local needs. Organizations also need to feed the PLM system with data from customer-facing systems to understand customer needs and create workflows to identify essential local needs.

Customizing products for customers in different geographies



Firmer suspension for Europeans who like sportier driving.

Heated, massaging rear seats for owners who are typically driven.

More robust cooling system for desert heat.

Left-hand driver placement for Western Hemisphere.



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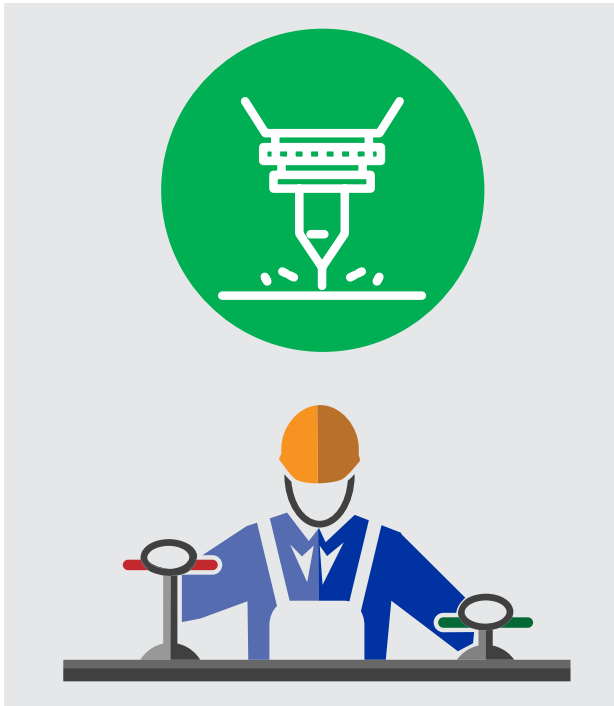
Looking ahead

The use of PLM in a digital context will fundamentally change relationships (for the better) with customers and product designers, as well as the business model. Four essential components for getting started with digital PLM include:

- 1 **Monetize** product data.
- 2 **Focus** on the customer.
- 3 **Orchestrate** new processes and business models.
- 4 **Assess** your product data maturity.

1 Monetize product data

Brainstorm how to use product data for your business and others in the product ecosystem. Cut costs through reduced support calls, returns and recalls. Boost revenue through improved quality, sales of parts and consumables, and improved products or sales/advertising driven by your understanding of customer usage trends.



Company A tracks reliability, accuracy of industrial laser on production line.



Company A sells that data to the laser manufacturer...



...which uses that data to improve the laser and prove its performance to other customers.

2 Focus on the customer

Create a physical location, such as a digital lab, to brainstorm new uses for PLM data with stakeholders. Use processes such as robust customer-scenario modeling to forecast the long-term impacts on the business model. Keep working toward closed-loop product development fueled by PLM systems that provide a single, comprehensive view of product data.



“Sell washing machine repair history to parts providers ...”

“Sell washing machine usage data to water district to encourage conservation ...”

“Use customer support records to improve product design ...”

3 Orchestrate new processes and business models

The insights generated by PLM with a digital perspective will force you to rethink everything from your manufacturing processes to how you collaborate with customers, partners and competitors. It will also require new skills and a need to leverage new technologies such as cloud, IoT and big data.



“How do we build a community of app developers to enhance this device?”



“What other product and service vendors touch our product throughout its lifecycle?”

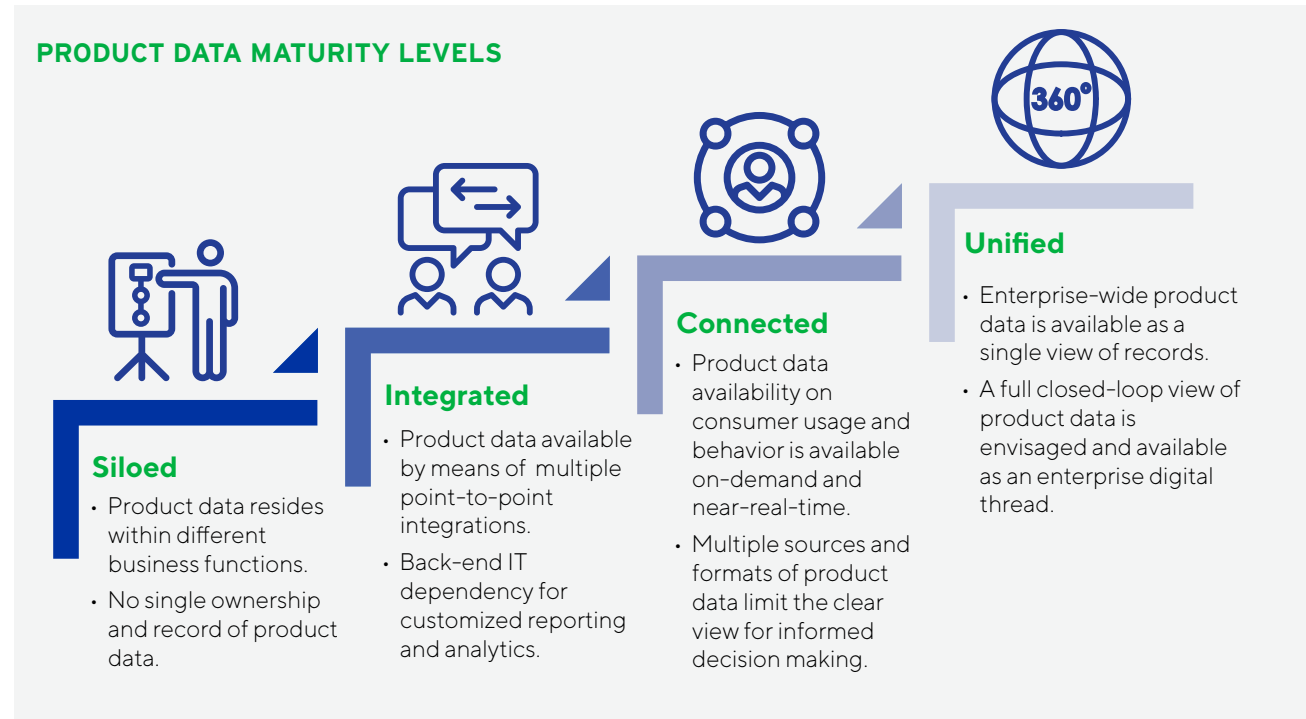


“How do we convince R&D to trust our product data and feedback from the support staff?”



4 Assess your product data maturity

Gather business and technical stakeholders to assess the quantity, quality, timeliness and comprehensiveness of your product data and your ability to understand it. Take into account both technical issues, such as the integration of multiple data silos, and business considerations, such as tailoring the presentation of the data to the needs of various internal and external stakeholders.



The changes unleashed by digital will make the next 10 years both challenging and vastly rewarding to those who can master the collection, analysis and use of product data. The ability to listen more closely than ever to the customer – or partner with someone who can – will fuel massive value creation as the blending of a product’s physical characteristics with its virtual capabilities becomes the rule rather than the exception.

Acknowledgments

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