INTEGRATED PRODUCT LIFECYCLE MANAGEMENT IN THE ERA OF IOT

Report Highlights

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40% of Best-in-Class manufacturers identify PLM as the primary application used for release management, and 33% identify it as the primary application for change management.

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Best-in-Class manufacturers are 47% more likely to meet their product launch targets.

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Best-in-Class firms cut their length of development time by 19%.

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63% of Best-in-Class firms integrate PLM with ALM (application lifecycle management).

This report discusses the importance of integrated PLM to enable the digital thread in developing smart, connected products that utilize the internet of things (IoT). Specifically, we will look at the way Best-in-Class firms use PLM as an innovation platform for digital transformation, to maximize their product development success.

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> **In the face of rising product complexity, integrated PLM has emerged as an innovation platform for digital transformation.**

Definition: Product Lifecycle Management (PLM)

The process of managing the entire lifecycle of a product, from inception, to post-market disposal, is called product lifecycle management (PLM).

In particular, PLM focuses on the upstream aspects of product development: ideation; creation; collaboration; digital manufacturing; virtual prototyping; product and plant simulation; engineering; realization; and compliance.

Today's smart, connected products have changed the rules for product development. The IoT is coming, and the products you develop are more innovative, more data-centric, and involve more software than ever. Manufacturer commitment to digital transformation is strong. Already, 27% of firms plan to achieve it.

These innovations have introduced a new level of complexity into the product development process, a complexity that profoundly affects the product lifecycle. In the face of this complexity, integrated PLM is emerging as an **innovation platform for digital transformation**. Several factors have positioned PLM for this critical role. First, PLM is entrenched; 61% of Best-in-Class firms have had a PLM solution in place for three or more years. Second, 40% of Best-in-Class manufacturers identify PLM as the primary application used for *release* management. Another 33% identify PLM as the primary application for *change* management.

Cross-Discipline Product Development Calls for Effective PLM

The need to launch complex products quickly, calls for continuous product innovation, and the desire to capitalize on expanding market opportunities, leave companies no choice. They must stay on the cutting-edge of development by utilizing PLM. Designing products for the internet of things, makes the need to improve cross-discipline product development even more urgent (Table 1).

Table 1: Products are Only Becoming More Complex

% Increase – Past Two Years	All Respondents
Number of Mechanical Components	**14%**
Lines of Software Code	**34%**
Number of Electrical Components	**21%**

Source: Aberdeen Group, May 2017

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Best-in-Class Product Development

Performance metrics that separate Best-in-Class firms from All Others

- Met Product Development Budgets
  Best-in-Class: 86%
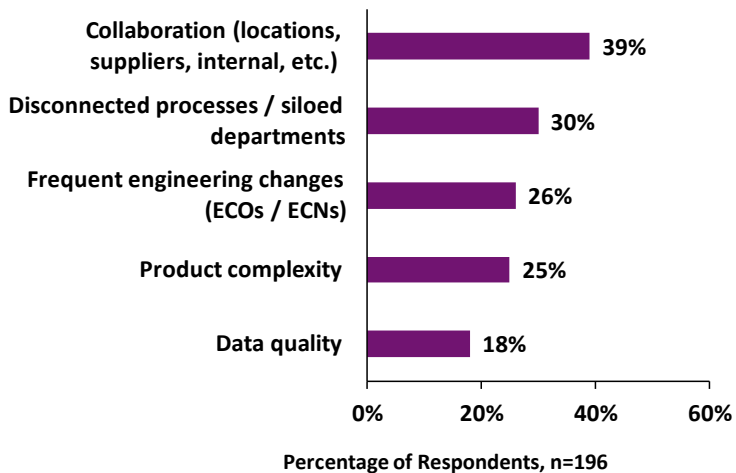 All Others: 59%

- Met Lifecycle Cost Targets
  Best-in-Class: 83%
  All Others: 62%

- Decrease in Overall Product Cost
  Best-in-Class: 17%
  All Others: 86%

By their nature, smart, connected products are cross-discipline, with the inclusion of new levels of software, electronics, and electrical components. (This is in addition to sophisticated mechanical designs.) As a result, the development process must be able to accommodate a broader range of product functionality – and higher levels of product reliability – without compromising power, form factor, or overall performance. For instance, the word "smart" implies the inclusion of software, and thus, PLM solutions must effectively manage both software and hardware product components.

The use of PLM to strategically transform business processes is also urgently needed to address the challenges of this new complex product development environment (Figure 1).

Figure 1: PLM Addresses Top Product Development Challenges

Collaboration (locations, suppliers, internal, etc.): 39%
Disconnected processes / siloed departments: 30%
Frequent engineering changes (ECOs / ECNs): 26%
Product complexity: 25%
Data quality: 18%

Percentage of Respondents, n=196

Source: Aberdeen Group, April 2017

The persistence of siloed departments is an impediment to product innovation; respondents said disconnected processes (i.e. lack of a digital thread) / siloed departments, was a top product development challenge. Related to the silo problem is an even bigger issue: collaboration; survey respondents said it was their single biggest challenge in the development process. In addition,

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as the complexity of connected products increases, frequent engineering changes and data quality issues, become greater challenges.

Defining the Best-in-Class

In its *PLM: Benchmarking New Product Development Processes* study, Aberdeen Group used five organizational performance metrics to identify top performing companies: product quality, product launch dates met, product cost targets met, product revenue met, and change in length of development time (increase or decrease). Respondents identified the frequency at which products met these targets in the past two years, forming two maturity classes: Best-in-Class (top 20%) and All Others (bottom 80%). Figure 2 highlights each group's performance:

Figure 2: Metrics Defining Best-in-Class Integrated PLM Users
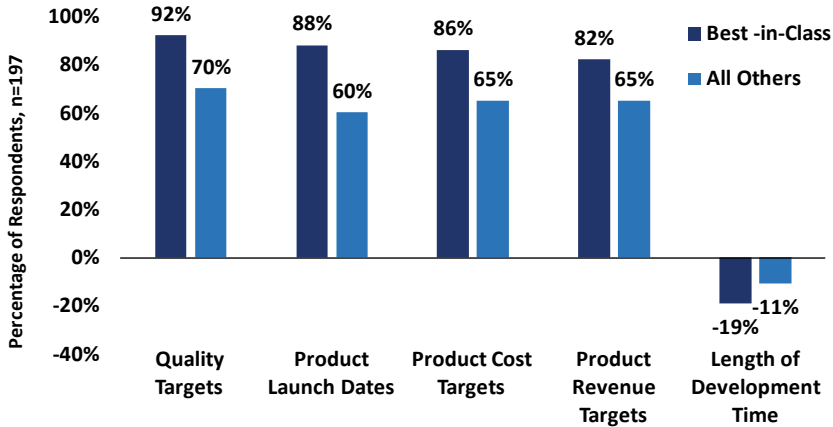
Source: Aberdeen Group, April 2017

Best-in-Class companies consistently outperformed their peers in all five target metrics. The percentage of products that met these targets, for example, were consistently over 80% for the Best-in-Class. The biggest difference between Best-in-Class and All Others can be seen in their ability to meet product launch dates, which the Best-in-Class were 47% more likely to do. This is significant,

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because a large part of new product introduction success is the on-time release of a product to market.

The high level of performance, exhibited by Best-in-Class organizations, is supported by the capabilities of integrated PLM.

PLM's Role in Digital Transformation: Enabling the Digital Thread

In the era of the IoT, PLM plays a critical role as the enabler of the digital thread across all stages of the product lifecycle. PLM accomplishes this by representing the product definition across the lifecycle and across product variants, providing traceability. This is critical, as the product definition changes at various lifecycle stages. PLM not only tracks data, processes, decisions, and results across the product lifecycle, it provides the ability to trace back in time all inputs, decisions, and data involved in product development. As digital transformation sweeps over manufacturing, PLM's role in enabling the digital thread and traceability truly positions it as an innovation platform for digital transformation.

PLM Capabilities for Streamlined End-to-End Operations

As firms begin to design smart, connected products, PLM now requires a more strategic, end-to-end approach, aimed at streamlining the entire product development cycle. Aberdeen Group research reveals that 57% of Best-in-Class firms have implemented an end-to-end application approach, and 34% plan to implement such an approach. In this environment, it is important to deploy integrated PLM that is flexible enough to adapt to changing connected product development needs. Given these challenges, what PLM capabilities are firms choosing?
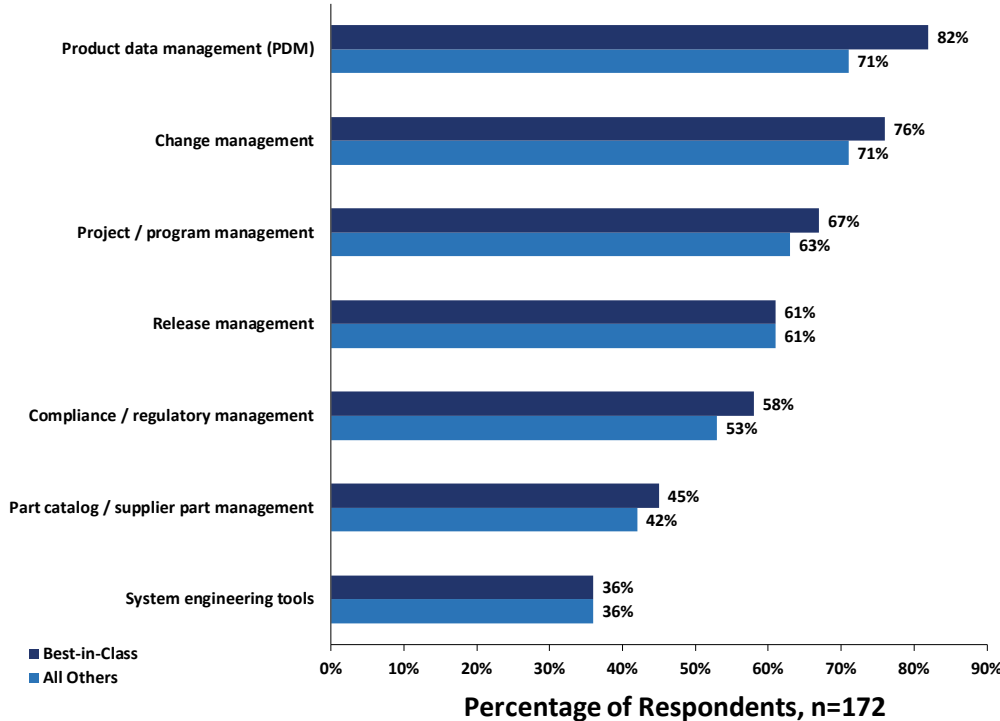
Aberdeen Group asked manufacturing organizations what capabilities should be part of an integrated PLM system. Figure 3, and the associated sidebar (next page), rank selected capabilities in order of importance.

Other Capabilities the Best-in-Class Looks for in an Integrated PLM System

- Process & Data Management:

  BOM management: 76%
  Requirements management: 61%
  Configuration management: 58%

- Collaboration:

  Collaboration Tools: 48%
  Visualization: 48%
  Idea management: 45%
  Virtual meetings: 24%

- Design & Engineering:

  Engineer to order capabilities: 36%
  CAD Tools: 27%
  CAE Tools: 12%
  CAM Tools: 9%

- Program & Portfolio Management:

  Portfolio management: 27%

- Systems Engineering:

  Digital Manufacturing: 21%

Figure 3: Select Capabilities Desired by Best-in-Class Firms in Integrated PLM

	Best-in-Class	All Others
Product data management (PDM)	82%	71%
Change management	76%	71%
Project / program management	67%	63%
Release management	61%	61%
Compliance / regulatory management	58%	53%
Part catalog / supplier part management	45%	42%
System engineering tools	36%	36%

Percentage of Respondents, n=172

Source: Aberdeen Group, April 2017

As one might expect, process and data management capabilities are of great importance to Best-in-Class manufacturers. Such capabilities include requirements management, configuration management, change management, release management, BOM management, product data management, and project / program management. Best-in-Class companies place such an emphasis on these capabilities, because solid data management effectively ties upstream processes, to downstream production, and enables the creation of the digital twin for each product.

Collaboration capabilities are also key for Best-in-Class firms (recall Figure 1). However, in the era of the IoT, another form of collaboration, the ability to connect the engineering workgroup

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into the upstream front end of innovation, is also highly prized. Open innovation starts with *ideation*; already, 45% of Best-in-Class firms see idea management as a necessary capability for PLM. Also strongly trending are product development collaboration portals; 40% of Best-in-Class respondents currently integrate content management systems, and 60% plan to do so. Finally, 24% cite virtual meetings as a desirable collaboration capability in PLM. These collaboration capabilities are instrumental in fostering closed-loop decision making for continuous improvement and business transformation.

Figure 4: Best-in-Class Closes the Loop with PLM Collaboration

- Best-in-Class
- Others

Source: Aberdeen Group, April 2017
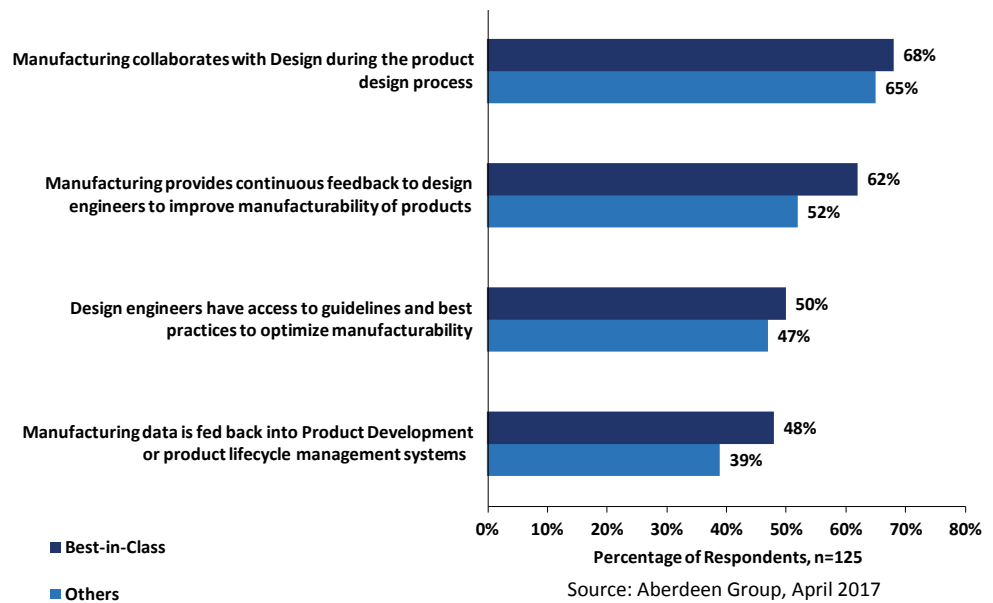
Aberdeen research shows that Best-in-Class firms excel at closing the loop between Product Development, Manufacturing, and Engineering organizations. Feeding product lifecycle results back – into different parts of the organization – enables learning and continuous improvement in product development, when combined with the product configuration context known as the digital twin. This is critical today, as the smart, connected products

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we design are engineered with software, hardware (electronics, electrical) and mechanical components.
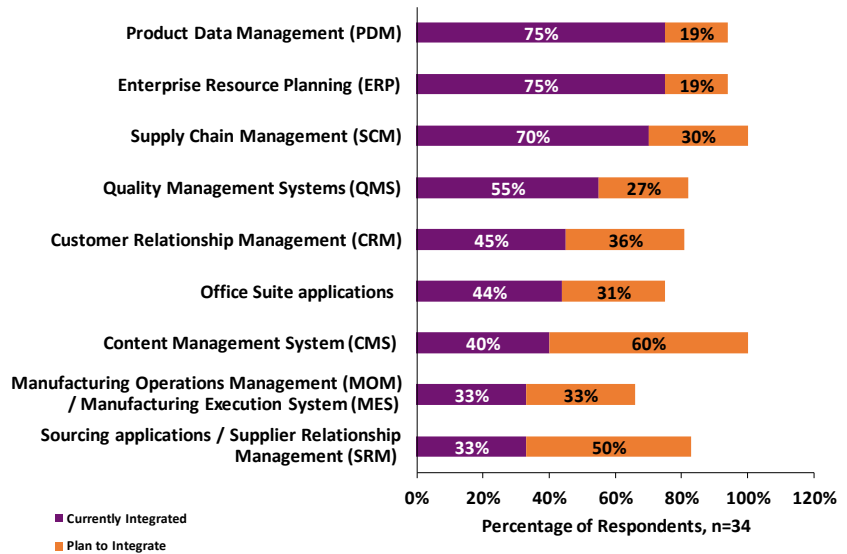
Compliance / regulatory management is also a highly desirable capability in coping with a web of requirements in a global environment. More than half of firms, Best-in-Class and All others alike, wanted this capability in their integrated PLM (see Figure 3, page 6). Regulations increase the demands on product data traceability throughout the lifecycle, known as the digital thread. Aberdeen Group research shows that 34% of manufacturers cite compliance with regulations as a top pressure. Fortunately, leading manufacturers are 30% more likely to have enabled full traceability of components and items, both upstream and downstream. Those with traceability are 2.7 times as likely to have real-time visibility into the status of all processes. Those with traceability are almost three times as likely to possess the capability to monitor for regulatory compliance.

Finally, systems engineering tools are uniformly respected as part of the PLM capability mix (36%). Moreover, these sophisticated tools are necessary to manage the mix of software, hardware (electronics, electrical) and mechanical components present in today's smart, connected products. Best-in-Class firms also apply systems engineering rigor – to avoid the costs of late-stage product development problems – by enabling continuous verification and validation. Such a systems engineering tool suite should extend to both the requirements management and the software engineering realm, where agile methodologies accelerate time-to-value in software delivery, while reducing operational costs and development cycle time.

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Open Architecture for Enterprise Integration

In addition to looking for PLM solutions with a broad range of capabilities, Best-in-Class manufacturers value open architecture PLM for its ability to integrate and interoperate with other enterprise systems. As an example, integration with software development is particularly critical today and going forward, with the number of lines of software code in products increasing 34% over the past two years. The importance of software management and software development integration, with PLM, is reflected in the fact that 63% of Best-in-Class firms are integrating PLM and ALM (Application Lifecycle Management). Along with ALM, most Best-in-Class firms have already integrated PLM with key systems, or have plans to do so (Figure 5).

Figure 5: Best-in-Class Firms Integrate PLM with Enterprise Systems

System	Currently Integrated	Plan to Integrate
Product Data Management (PDM)	75%	19%
Enterprise Resource Planning (ERP)	75%	19%
Supply Chain Management (SCM)	70%	30%
Quality Management Systems (QMS)	55%	27%
Customer Relationship Management (CRM)	45%	36%
Office Suite applications	44%	31%
Content Management System (CMS)	40%	60%
Manufacturing Operations Management (MOM) / Manufacturing Execution System (MES)	33%	33%
Sourcing applications / Supplier Relationship Management (SRM)	33%	50%

Percentage of Respondents, n=34

Source: Aberdeen Group, April 2017

Downstream, PLM's boundaries have extended to suppliers; 70% of Best-in-Class have integrated Supply Chain Management (SCM) into their PLM solutions, and 30% plan to. Closely related to this,

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one third of Best-in-Class respondents have integrated PLM with, sourcing applications / supplier relationship management (SRM). An additional 50% plan to undertake such an integration.

PLM: Innovation Platform for Digital Transformation

Since its inception, PLM has always been about return on investment and bringing products to market faster, by reducing development and production time, cutting costs, and maintaining product quality. That's still the case today. Going forward, however, manufacturers expect more. Best-in-Class users are counting on PLM as the enabler of the digital thread across all stages of the product development lifecycle. In upscaling PLM's strategic role to that of an innovation platform for digital transformation, integrated capabilities combined with the flexibility to streamline manufacturing of smart, connected IoT products will be key in an Industry 4.0 / industrial internet setting.

An integrated PLM solution reconnects siloed processes and departments. It streamlines and speeds up product development by facilitating cross-discipline communication, and cross-functional collaboration, throughout the organization.

As integrated PLM becomes an innovation platform, its capabilities have expanded both upstream and downstream:

➔ Upstream to the ideation phase (idea management) and to production collaboration portals.

➔ Downstream to Supply Chain Management and even to connected products in the field, which feed data back into PLM (via the IoT) for the purposes of continuous engineering.

Best-in-Class manufacturers also integrate open architecture PLM into other enterprise applications, speeding up manufacturing velocity and boosting operational effectiveness. In the era of

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cross-discipline product development, integration with software management, software development, and ALM is essential. PLM is also a manufacturing cornerstone application, and 94% or more of Best-in-Class firms also integrate (or plan to integrate) PLM with ERP, SCM, and CRM. And that's just the start; PLM links to QMS, MOM/MES, and SRM links create synchronicity and visibility across the manufacturing enterprise.

What other developments wait in the wings for integrated PLM in the age of the IoT? As always, keep an eye on the Cloud. Organizations should also consider a cloud-based PLM platform for additional benefits. Aberdeen Group survey respondents identified lower cost, faster implementation speed, and scalability, as top benefits of cloud-based solutions. Choosing a PLM solution provider offering premises-based, cloud-based, and software-as-a-service (SaaS) options, provides additional flexibility as business needs and preferred software delivery models change.

Smart, connected products have changed the product development process. In the face of this, PLM software is now undergoing tremendous renewal, as it emerges as an innovation platform for digital transformation. Innovation begins with accepting that the product development process has changed, and is opening up to new ways of doing things. The Best-in-Class have made this leap, deploying PLM to enable the digital thread. Others should do the same.

For more information on this or other research topics, please visit www.aberdeen.com.

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Related Research

Data Management in PLM: Optimize Your Business Performance; March 2016

Product Traceability: Tracing the Key to Manufacturing Success; December 2015

Product Development in the Era of IoT: Tying the Digital Thread; April 2017

Data Management for the Internet of Things; February 2015

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About Aberdeen Group

Since 1988, Aberdeen Group has published research that helps businesses worldwide improve their performance. Our analysts derive fact-based, vendor-agnostic insights from a proprietary analytical framework, which identifies Best-in-Class organizations from primary research conducted with industry practitioners. The resulting research content is used by hundreds of thousands of business professionals to drive smarter decision-making and improve business strategy. Aberdeen Group is headquartered in Waltham, MA.

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