TECHNOLOGY SPOTLIGHT

Digital Transformation: Cloud PLM Scenarios for Global Enterprises

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Adapted from *PLM in the Cloud — Hybrid Approach Prominent, Quality an Emerging Focus* by Jeff Hojlo, IDC #MI258494

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This paper examines the need for as well as the opportunities and challenges associated with deploying different product life-cycle management (PLM) scenarios in the cloud. It also discusses the specific scenarios that global enterprises will consider for PLM in the cloud and looks at the role of Aras in this growing market.

Introduction

How products across discrete and process manufacturing industries are designed, developed, manufactured, serviced, and improved has changed dramatically over the past five years, and the pace of change continues to accelerate. In short, innovation is digitally transforming, and many large manufacturers are working rapidly to capitalize. Thus PLM solutions, and how PLM data and processes are consumed, are changing greatly as part of the digital transformation in product development.

Design, development, R&D, and engineering no longer happen in isolated engineering or R&D workgroups; they occur across a diverse set of participants — engineers, designers, and "nonengineers," including marketing, sales, supply chain, manufacturing, quality, and service professionals who are employees and external partners. Due to this dynamic, "PLM" needs to extend outward from the engineering to include new participants from each of the aforementioned domains. The reasons global manufacturers are beginning to look at new approaches to PLM — most notably, a product innovation platform — can be summed up as speed, complexity, and change. More specifically, the reasons include:

- **Product complexity.** Discrete manufactured products, particularly Internet of Things (IoT)–enabled products, have more software within them and need to be modeled and developed with a systems engineering approach undertaken by a disparate, global team of software, mechanical, electrical, and manufacturing engineers. Process manufactured products also have to address material, quality, and compliance complexity as well as the challenges of increasingly smart and connected packaging and processes and of finding the right, profitable portfolio mix.

- **Dynamic demand.** Customer demand is very dynamic with the mass customization, personalization, and new business models of products — such as product as a service — so processes must be in place that can adequately sense and respond to support fast-changing requirements.

- **Increased number of external partners.** Global companies increasingly work with more partners, suppliers, and even customers to make better products and need to enable easy collaboration and open innovation while maintaining protection of intellectual property (IP).

- **Global expansion and competition.** Large manufacturers are expanding worldwide into new, local markets and face tough competition, so they must be able to design and develop products quickly to suit unique needs and regional or country-specific regulations.

- **Enormous increase in the amount of data that can fuel innovation.** Making products IoT connected leads to a lot of high-value information created about product performance, usage, reliability, and service that should be unified for maximum benefit. Customer, quality, manufacturing, and supply chain data can complement this information in a broader context.

- **3rd Platform technologies.** Social business, big data and analytics, mobile and, yes, cloud are the disruptive technologies that have emerged to transform product development. These technologies are the primary reason why an extended, transformative view of how products are designed, developed, and supplied is possible now.

Complexity exists on so many levels — product, process, business model, value chain — that a product innovation platform has become a business imperative for global enterprises pursuing a digital transformation. Cloud in particular offers an alternate infrastructure approach when addressing these complexities and enabling digital transformation in product development. Most companies have watched the cloud hype with skepticism, particularly for PLM. Yet, global enterprises are finding an increasing range of scenarios where the cloud can make sense in PLM.

Cloud PLM Scenarios

As more and more large manufacturers see the benefits of using the cloud in select situations and come to terms with concerns about security and performance, we anticipate that the paradigm for cloud in PLM will continue to change. By targeting the cloud for specific scenarios, global enterprises can begin the digital transformation by supporting key PLM processes that require speed, accessibility, and rapid decision support.

Many manufacturers are already enjoying the benefits of some critical PLM processes deployed in this manner — mission-critical data and processes that directly touch the customer or supply chain in particular — including quality management, customer support, service management, supplier collaboration, and design review. The relative ease of deployment in the cloud and the ability to make PLM seats readily available to an extended value chain offer clear advantages over more traditional on-premise PLM approaches.

The cloud also offers an opportunity to avoid disruption while strategically targeting processes and product lines for digital transformation activities. Companies can start using specific functionality in new PLM options — such as product innovation platform capabilities (see Figure 1) — without having to completely replace their current PLM system.

Today, we see multiple scenarios benefiting most from the use of the cloud — whether public, private, community (private cloud extended externally), or hybrid (public or private + on-premise) — which can be divided into four major buckets:

- Specific processes or product lines for innovation, speed, quality

- Extended value chain collaboration

- Mergers and acquisitions, divestitures, and joint ventures

- IoT and connected products

Another area where we see global manufacturers leveraging the cloud is in running PLM evaluations, pilots, or proof of concepts. This enables the company to quickly determine yea or nay on the system, decide whether a proposed solution will work, and conclude how best to move forward.

FIGURE 1

The Product Innovation Platform Framework
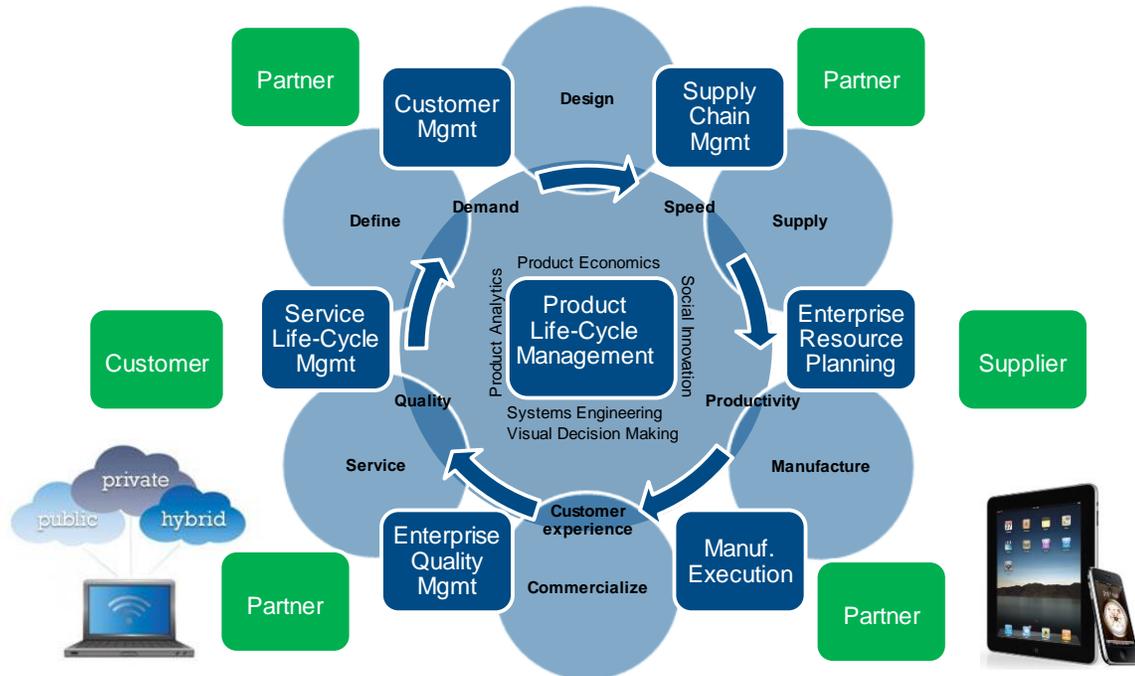
Source: IDC Manufacturing Insights, 2016

Specific Processes or Product Lines for Innovation, Speed, Quality

Today, very few large, global enterprises are considering using the cloud for their entire PLM environment. Instead, with regard to PLM, in many cases large manufacturers appear to view the cloud as an enabler that can be utilized to satisfy pressing needs when an existing PLM system lacks functionality or will take too long. Specific processes and product lines that have immediate requirements for PLM capabilities are one of the scenarios where companies can take advantage of the cloud. Functionality can be deployed quickly and can be integrated with an existing PLM system either as part of the initial deployment or in later phases, which provides additional flexibility.

In IDC Manufacturing Insights' 2014 *Product and Service Innovation Survey,* global manufacturers responded that they viewed quality data as a top candidate for a cloud environment — most likely, we think, to meet speed, market, and competitive demands. The same research found that product quality is a primary reason why large manufacturers use PLM to manage product, program, collaboration, and manufacturing complexity. Using the cloud for PLM in quality processes makes sense to manage and analyze the flow of information that exists and achieve a high level of product and service quality, as well as meet compliance demands. IDC Manufacturing Insights thinks that when quality is enabled by PLM with the cloud, manufacturers can expect more rapid execution of engineering change orders (ECOs), enablement of future product improvement and innovation, assurance of global regulatory compliance, and reduction in the risk of liability.

For development processes, ideation, at the very front end of innovation, has long been a PLM scenario that has had traction in the cloud. This again is due to the ease of information flow, collaboration, and engagement that a cloud environment offers — perfect for the free-flowing nature of coming up with new

products or solutions to existing problems. Other process scenarios that represent opportunities include design review and enterprise change management, especially when suppliers, customers, and contract manufacturers are involved. One consistent tie between these processes is design visualization as manufacturers see the value in maintaining a digital twin across these processes, even if only a lightweight digital mock-up of a product or one that is enhanced with manufacturing or service work instructions. We see digital twins — the complete, system-level representation of a product with mechanical, electronics, electrical, software, firmware, and other important information — becoming more prevalent at complex discrete manufacturers, available in the cloud to update and optimize products as necessary.

This approach of global enterprises targeting specific processes and product lines using the cloud will continue as manufacturers move to digitally transform their businesses and the way that they design, develop, and launch products with a product innovation platform.

Extended Value Chain Collaboration

Not only does massive complexity exist at large companies today, but products need to be developed more quickly in conjunction with an increasing number of suppliers, partners, and customers worldwide. Therefore, enabling easier external collaboration with secure access to product information for the entire engineering team is critically important. When the extended value chain is brought together in this fashion, visibility improves, faster collaboration occurs, and project execution is better.

Collaboration outside the four walls is necessary for global engineering with both internal constituents across the business and strategic partners at contract manufacturers, design partners, suppliers, service providers, and academia. These processes, by definition, occur outside the firewall and include a diverse group such as mechanical, electronics, and software engineers at different companies around the world.

For large companies working in an extended value chain or complex supply chain, the cloud can provide a better way to enable PLM information flow and secure collaboration. These processes also constantly morph, merge, and change, and thus the PLM capabilities used need greater adaptability than conventional PLM implementations where process standardization may be the priority.

Using the cloud enables scalable collaboration and provides rapid flexibility in collaboration among a diverse set of product development constituents, inside or outside the firewall, leading to products that are of higher quality and that are brought to market more quickly.

Mergers and Acquisitions, Divestitures, and Joint Ventures

Mergers and acquisitions (M&As), divestitures, and joint ventures (JVs) are all commonplace in global enterprises and represent another set of potential scenarios for using PLM in the cloud. In the case of M&As and divestitures, the potential for product development to be adversely affected is significant. In these situations, product data must be separated in order for the organization to be moved to its new owner; however, engineering needs to continue uninterrupted. Because corporate transactions can take months, quarters, or even years to complete, product development needs a way to continue operating without disruption. JVs represent a different challenge; however, the need to set up a separate PLM environment quickly is quite similar.

Using the cloud to establish a dedicated PLM solution for the business unit, division, or JV during these scenarios can provide the necessary capabilities for product development and other processes. In these cases, it's not as if solutions are being displaced in favor of the cloud. Rather, the cloud can be used as a cost-effective, convenient, and fast way to provide PLM capabilities where otherwise the organization may have had to resort to spreadsheets and email, which could jeopardize schedules, cause mistakes, and introduce intellectual property risk. Some manufacturers, for example, have looked to add a program and project management layer on top of existing PLM and CAD offerings to manage the flow of information between the two systems.

Whether the cloud PLM solution remains a temporary or long-lasting environment depends on the situation — it may be that it exists only for the acquired business to continue operating before it is brought into an existing PLM, or in other cases, such as JVs, it may be an indefinite duration.

IoT and Connected Products

The IoT and connected products are growing very fast (30+ billion connected products expected across industry by 2020 per IDC's research) and in many cases are driving the digital transformation at global enterprises. This trend is forcing the need for a PLM approach that offers greater cross-discipline coordination and can manage mechatronic design and systems engineering while enabling value chain collaboration, closed loop analytics, and field service support.

Software development has become critical — putting the "smart" in "smart products" — and now more than ever needs to be brought together with the other engineering domains at the system level. If multiple existing PLM, product data management (PDM), and application life-cycle management (ALM) systems need to work together to support different engineering disciplines (mechanical, electronic, software), using cloud-based product innovation platform capabilities can provide a new option to enable better cross-discipline coordination — most likely meaning layering over and integrating as opposed to replacing the existing systems.

Other scenarios large manufacturers can consider include using product innovation platform capabilities in the cloud to associate and analyze data from connected products and smart manufacturing systems in the industrial IoT. For example, one key process involves tying actual IoT performance data into the failure mode and effects analysis (FMEA) during design to reduce product risk while improving quality, reliability, and durability for a better customer experience.

In all these scenarios, openness is critical in the PLM and cloud environments. Global enterprises must control the data and the data model and be able to integrate and extract data easily as needed.

The potential points of integration for these types of scenarios can include:

- Existing PLM, PDM, and ALM systems

- Other enterprise systems inside and outside the company that may be on-premise or cloud based

- Increasingly diverse sets of cloud-based data, services, and analytics

Industry Scenarios

Global enterprises in every industry have the opportunity to benefit from deploying select PLM scenarios in the cloud. For industries where speed to market is critically important, customer demand changes regularly, innovation and technology advances are rapid, and low-priced competition is stiff (which describes most industries on some level), a full-scale cloud PLM deployment may actually be the eventual endgame. However, we think that for now, the following conditions will motivate large manufacturers in each industry to incorporate some set of cloud scenarios into their PLM approach:

- **High tech and consumer electronics.** IoT and connected products that drive the need for rapid design, innovation, and collaboration, especially as complexity continues to increase

- **Automotive.** Increasing software content combined with OEMs and tier suppliers collaborating more closely with high-tech partners for "smart," connected vehicles and autonomous cars

- **Aerospace and defense (A&D).** The requirement for each program to have a separate PLM environment that in many cases must enable secure communication across a complex, multitiered supply chain

- **Medical device.** Research and development with partners and contract manufacturers that also requires iterative design, collaboration, quality management, and regulatory compliance

- **Pharmaceuticals, food and beverage.** Increasing maze of global regulatory and compliance mandates that must be adhered to for higher product quality levels and reduced liability risk

- **Retail and apparel.** Supplier performance management, validation, material testing, sourcing, and collaboration that are critically important and can be expedited in a cloud environment

- **Consumer goods.** Greater product complexity with the introduction of wearable technologies, smart packaging, and mobile apps for new consumer experiences

Cloud PLM Considerations

The complexity we have discussed at the product, system, and value chain levels means great opportunity for PLM providers such as Aras that can run natively in cloud and hybrid deployments. Flexibility and the ability to support large manufacturers' desired deployment state — whether private or public cloud, classic on-premise, or a combination — will be advantages moving forward. The cloud offers an increasingly attractive way to automate a wide variety of scenarios, whether standing up a brand-new system or overlaid on and integrated to existing PLM, PDM, and/or ALM systems.

The key capabilities for global enterprises that a PLM platform running in the cloud needs to provide, given these dynamics, include the following:

- **Full-scale, cross-domain PLM.** Systems engineering, product costing, configuration and change management, project and program management

- **Embedded quality.** The top reason why manufacturers employ a PLM system

- **Open, Web based.** Pure Web, standards-based open architecture

- **Secure.** Robust role-based security

- **High system flexibility.** Ability to customize, highly scalable, strong integration capabilities

- **Secure social collaboration.** Among global teams and external partners/suppliers

- **PLM analytics.** Rich analytics to connect the dots

- **Rapid upgrades and maintenance.** Ability to control when upgrades occur and perform updates easily even when highly customized and/or integrated with multiple systems

- **Subscription pricing.** Subscription license format that includes upgrades

Considering Aras

IDC Manufacturing Insights thinks that Aras is well positioned to meet these requirements as a scalable, flexible platform with a full range of out-of-the-box functionality that can be configured and customized to the needs of large manufacturers. Aras can be deployed on-premise, in the private cloud (such as CloudSAFE, T-Systems, or others), in the public cloud (such as Microsoft Azure), and in a hybrid approach with some data and processes existing on-premise and some processes deployed in the cloud. Aras' key cloud-based PLM offerings support the aforementioned needs and include:

- BOM management
- Configuration and change management

- Project management

- Quality management

- Requirements and systems engineering

- Visual collaboration

- Integrations

- Reporting and analytics

Aras can also support systems engineering initiatives and complicated life-cycle processes, which are important in today's world of connected products and complex product configurations.

Challenges

Global enterprises tend to take a conservative approach to PLM, and the majority of PLM deployments today are still on-premise. Selecting the appropriate scenario and scope to apply PLM in the cloud can have many considerations. One place to experiment with the cloud for PLM can be for new greenfield situations where there is currently no PLM system in place and perhaps Office tools and email are being used — whether a single product line, a division, or an enterprisewide process. Additionally, when an organization needs to minimize capital expenditures, the low entry cost of a subscription and pay-as-you-go nature provide advantages.

Security in the cloud remains a primary concern for many large companies. Taking a targeted approach to cloud enablement of PLM scenarios can reduce security concerns. Comparative analysis can also be performed and may find that cloud security is comparable to or better than existing on-premise security.

Scalability of PLM running in the cloud is another area that global enterprises have questioned to date. Today's modern cloud environments have the ability to scale to support large, complex assemblies and data and the capacity to deliver performance for the largest user counts.

As large manufacturers look to enable specific PLM scenarios in the cloud — whether design collaboration, quality, analytics, or M&A — speed, complexity, and change will continue to be the driving factors as well as the challenges that need to be mitigated.

Conclusion

For most large, global enterprises, the ability to use PLM in the cloud for select scenarios makes sense — whether public, private, or hybrid. The ongoing digital transformation is driving large manufacturers to target some of their key PLM processes and data for deployment in the cloud.

As companies undertake some of the PLM scenarios outlined in this paper using the cloud, we believe they will realize that true advantages can be gained by enabling greater cross-discipline coordination and extended value chain collaboration. This alternative approach may involve a dedicated, standalone PLM environment in the cloud or one that ties multiple processes and existing systems together, which can involve effort, but certainly not more than ripping and replacing.

Some global manufacturers may feel more comfortable keeping everything on-premise into the future without considering using the cloud for even select scenarios; however, IDC Manufacturing Insights believes this attitude will change over time as large enterprises become more comfortable with some of the scenarios outlined in this paper and realize that there are great advantages to opening the innovation process, managing and processing large amounts of product and process data, and enabling collaboration across disparate, cross-domain teams in the cloud.

Increasingly, manufacturers will seek to enable new processes using the next generation of PLM, what we call a product innovation platform. We view Aras as a viable option to consider for cloud-based PLM initiatives, particularly in this age of mixed cloud deployment approaches utilized by the largest global enterprises.

For global enterprises focused on a hybrid cloud PLM approach, a strategic deployment of targeted, cloud-based PLM scenarios can provide tremendous benefit, alleviating cost and integration concerns and enabling faster collaboration, faster time to value, improved product quality, and innovation transformation.