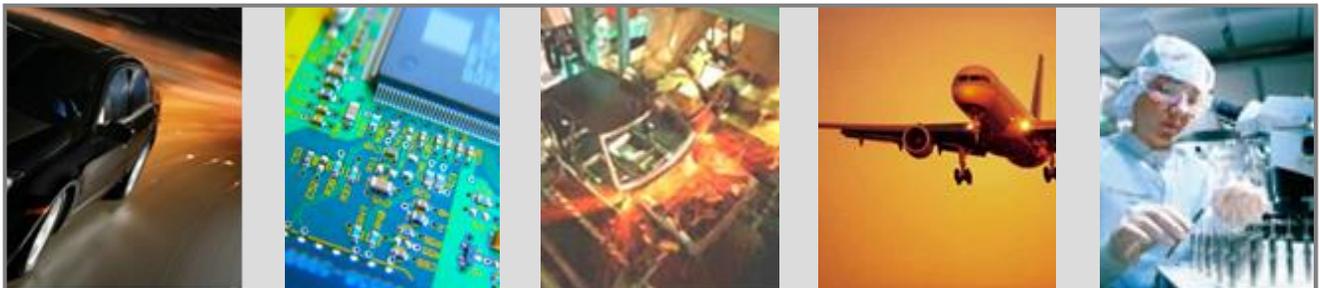


Lean in Product Development

Key Strategies to Successfully Implement Lean Development and the Synergies with Advanced Product Quality Planning

by Marc Lind



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Executive Summary

Fierce competitive conditions are driving companies to adopt Lean strategies to improve corporate financial performance. Eliminating risk in execution as new products are brought to market to fuel growth is an imperative to achieving success. Lean strategies are increasingly being extended to include groups outside of operations; most notably product development. To date, very few companies have successfully implemented Lean in the product development process.

The obstacles to implementing Lean in product development often stem from a lack of understanding of the different approaches; *Lean Engineering*, *Lean Design*, and *Lean Development*. Each approach has associated implementation challenges and will require a different plan. This paper focuses on the *Lean Development* approach which incorporates core considerations for the elements of the Lean enterprise environments during product development.

Lean Development integrates Lean preproduction preparation activities as deliverables within the appropriate product development phases to ensure readiness at product launch eliminating waste and reducing product development cycle times. Core consideration examples include:

- What are the design requirements essential to Customer Value?
- Will a new product slot into an existing Lean Product Family or will it constitute an entirely new Lean Product Family?
- Will materials, components, parts, and assemblies be sourced from 'preferred' suppliers qualified for pull-based Kanban fulfillment?

The right combination of core considerations depends on the company's specific competitive practices and the nature of the company's Lean environment and supply chain. *Lean Development* can be applied independent of either of the other two approaches; however, if one of the other approaches is applied *Lean Development* must still be included to effectively plan for Lean manufacturing and supply chain operations.

Implementing *Lean Development* is relatively straightforward and un-intrusive to ongoing product development projects and has a minimal cultural impact on the engineering organization. In addition, *Lean Development* fits well within a company's existing phase-based product development process such as Advanced Product Quality Planning [APQP].

Because today's geographically distributed product development teams involve primarily knowledge worker processes when implementing any of the three different approaches [*Lean Engineering*, *Lean Design*, or *Lean Development*] software technology will invariably play a role. It is important to focus on software that supports the overall product development process as opposed to individual steps and activities. Any software solution used to support Lean in product development should include process structure and visual management as well as have a high degree of flexibility to adapt to changing business conditions.

Strategic Adoption of Lean

As global competition continues to intensify across industries, companies are actively pursuing strategies that will enable them to compete more effectively and improve profitability. Over the past decade the application of the Lean principles has emerged as the primary improvement strategy in companies around the world. The Lean principles that stem from the Toyota Production System [or TPS] have over the past decade expanded to incorporate other concepts resulting in variants such as Lean Sigma. Together the different variations of the Lean approach have emerged as the predominant strategy for achieving operational excellence.

While Lean has been embraced as a key corporate strategy by a growing number of companies the implementation of Lean principles has been limited to primarily production and supply chain operations. Product development and engineering organizations have for the most part only received training in Lean concepts and tools without clear applicability.

Lean in Product Development

There are numerous perspectives on exactly what Lean in product development and engineering constitutes. Fundamentally there are three different approaches:

- **Lean Engineering** – Applying Lean principles to engineering; flow, pull, standardized work, takt time, and other Lean principles through common Lean techniques and tools used in operations.
- **Lean Design** – Adopting fundamentally different engineering methodologies as identified in the book *Product Development for the Lean Enterprise* by Michael Kennedy such as set-based design.
- **Lean Development** – Accounting for the necessary core considerations that the Lean manufacturing environment and Lean supply chain require.

It is important to note that there is no progression between the three approaches; *Lean Engineering*, *Lean Design*, and *Lean Development*. None of the approaches is a prerequisite for the others. A company can implement one or more of the approaches in any order. However, no matter how a company decides to implement Lean in the product development organization the overall product development process must comprehend the essential elements of the Lean manufacturing environment and the Lean supply chain. In effect, both *Lean Engineering* and *Lean Design* will need to incorporate the third approach, *Lean Development*. In fact, if a company is applying Lean principles in manufacturing and the supply chain the *Lean Development* approach is a natural extension back into the product development process and can be applied independent of the other two approaches.

Anticipating Challenges

There are both practical and cultural challenges with any initiative that requires people to change the way they work. When identifying the right approach or combination of approaches for implementing Lean in product development it is important to take into account both the practical and organizational issues the company is likely to face.

The most common practical challenge faced in the product development process occurs with the application of the *Lean Engineering* approach. An obstacle often arises as attempts are made to achieve Flow, an important component in instituting Lean operations principles. To achieve consistent Flow the process is broken down into Standard Work elements. Standard Work is typically defined as "a precise description of each work activity specifying cycle time, takt time, and the work sequence of specific tasks" and assumes minimal variation in cycle time.

The practical challenge in achieving Flow in product development is that in many cases conditions and circumstances are unique leading to an unacceptable level of variation in certain work activities. Without achieving consistent Flow in the process other aspects of a *Lean Engineering* initiative become complicated, break down, and can become counter productive leading to frustration and diminished results. Therefore, the *Lean Engineering* approach is best applied to product development processes where activities, conditions, and circumstances are the same from product to product over time.

The most common cultural challenge faced when implementing any of the Lean approaches to product development is organizational resistance on behalf of engineers. For example, the *Lean Design* approach involves a fundamentally different way of designing products. The process and information utilized to make decisions are unconventional, albeit very powerful. The improvement potential of the *Lean Design* approach if fully embraced includes considerable cycle time reductions as well as new opportunities for innovation and knowledge sharing. The risks however lie in the ability of engineers, particularly in management, to unlearn traditional engineering methodologies and adopt entirely new practices. Engineers and executives educated in traditional methodologies may not understand the *Lean Design* approach potentially resulting in cultural resistance that impedes successful implementation.

At the end of the day, no matter which approach is applied cultural challenges due to organizational resistance can be anticipated. The ability to select which approach fits best with a company's goals and circumstances and what implementation strategy is most appropriate to achieve success is the real challenge.

Path of Least Resistance

One of the more straightforward implementation strategies is to begin by applying the *Lean Development* approach first and follow with either *Lean Engineering* or *Lean Design* as a second stage. The reason for this strategy is that *Lean Development* can be applied independent of either of the other approaches; however, if one of the other approaches is applied *Lean Development* should still be included.

Lean Development basically accounts for all of the elements of the Lean manufacturing and supply chain environments during product development. *Lean Development* achieves reduced product development cycle times and better coordination at product launch resulting in reduced risk, improved quality, greater yields, and higher margins at new product introduction.

Lean Development provides a straightforward way to begin the Lean journey in engineering because the approach is relatively un-intrusive and therefore has a minimal cultural impact on the engineering organization. In fact, many companies apply a basic level of the *Lean Development* without realizing.

Lean Development Core Considerations

The *Lean Development* approach effectively constitutes product development *for* Lean manufacturing. The basic premise is to incorporate Lean preproduction preparation activities upstream in the product development process as deliverables or triggers for activities.

By integrating Lean preparation and planning activities within the appropriate product development phases a company is able to ensure readiness at product launch in the Lean manufacturing and supply chain environments as well as eliminate wastes such as waiting time waste or overprocessing waste. Examples of the *Lean Development* core considerations include:

- What are the design requirements essential to Customer Value?
- Will a new product slot into an existing Lean Product Family or will it constitute an entirely new Lean Product Family?
- What mistake proofing (Poka Yoke) design elements can be included?
- Will all or part of an existing Value Stream be leveraged by a new product or will a new Value Stream be defined?
- Will materials, components, parts, and assemblies be sourced from 'preferred' suppliers qualified for pull-based Kanban fulfillment?
- Will the new product target an existing Mixed Model line or work cells?
- Will new tooling or equipment include consideration for 'quick change over' SMED capabilities in the specification, design, and selection?

These are some of the many *Lean Development* core consideration a company should be performing during product development for each

new product. Other related activities can include new product Value Analysis, Value Engineering, Design for Six Sigma [DFSS], Design for Manufacturability / Design for Assembly [DFM/DFA], Risk Analysis, and numerous other Lean-related engineering preproduction activities. The right combination of core considerations depends on the company's specific competitive practices and the nature of the company's Lean environment and supply chain.

The Power of Simplicity

The simplicity of the *Lean Development* approach is part of its power. Implementation can be performed as either a series of Kaizens, a reengineering project, or incrementally through continuous improvement. An organization can choose the implementation style that best suits the circumstances and corporate culture.

Due to the low impact nature of the *Lean Development* approach ongoing new product projects experience little or no disruption and the cultural change implications for the engineering organization are relatively minor.

Three important aspects that deserve some thought when implementing *Lean Development* are:

1. Identifying the appropriate Lean deliverables and activities to include in product development to support the company's Lean strategy,
2. Slotting the different Lean deliverables and activities into the right development phases of the new product program process, and
3. Defining the Lean deliverables and activities that represent milestones or gates in the product development process [if any].

The most straightforward way to begin implementing *Lean Development* is to simply start incorporating core considerations into the existing product development or new product program process.

Companies with a well defined phase-based product development process in place such as an Advanced Product Quality Planning [APQP] process have an excellent mechanism for implementing *Lean Development*.

Advanced Product Quality Planning Synergy

Advanced Product Quality Planning [APQP] is a product program management structure that defines phases and deliverables associated with the development of a new product.

Originally developed by the Automotive industry as part of the QS9000 standard [now ISO/TS 16949] the APQP format is being adopted across industries such as High Tech, Industrial Products, Aerospace & Defense, and Medical Devices as a best practice for defining phase-based product development programs.

Forward thinking companies are recognizing the need to integrate compliance mandates such as APQP in creative ways to improve their ability to compete. By using APQP or other similar phase-based product development processes as a framework that supports specific competitive practices a company can leverage necessary compliance processes to truly support the Lean environment and achieve superior performance.

The APQP process identifies sets of compliance deliverables grouped by phase. Companies integrate *Lean Development* core considerations into each phase of the APQP process. For example, companies incorporate Value Analysis in the new product program initiation phase and Poka Yoke mistake proofing in the product design phase.

The *Lean Development* deliverables represent the inclusion of a company's proprietary competitive practices within the standard APQP framework. APQP is transformed from a compliance requirement into a process that is as important to the company's strategic operations as critical to the company's quality practices.

Technology's Supporting Role

Product development and engineering in today's world are primarily knowledge worker processes heavily reliant on information technology. Globally distributed teams utilize automation software in each role and for every aspect of the process. It is increasingly difficult to perform new product development without the many different software technologies used for design, simulation, and collaboration.

However, the role of many software technologies in product development is analogous to that of machine tool automation in manufacturing. Individual tools such as CAD software and simulation tools optimize individual operations without regard to the overall process of product development. Many different functions and activities are required to bring new products to market quickly. Coordination and synchronization must be achieved across design engineering, quality engineering, product test engineering, manufacturing engineering, supply chain & procurement, marketing, and sales. Speeding up a select handful of operations can actually be counter productive to overall process efficiency causing waste and resulting in cycle time increases.

Because the location of participants in the product development process is increasingly geographically distributed, whether across town or around the globe, companies need collaboration technology to communicate. However, information gets out of date quickly and revision accuracy problems arise when teams rely on emailing files and periodic online sessions. Decisions are made with incorrect or incomplete information resulting in waste causing mistakes and rework that effect development schedules, product quality, and ultimately bottom line financial performance.

To effectively implement Lean in product development with any of the three previously identified approaches [*Lean Engineering, Lean Design, or Lean Development*] a company must focus on the overall process. Point applications and tools are unable to support the necessary process aspects required due to limited scope and an inability to manage complex business processes. Enterprise software such as a Product Lifecycle Management [PLM] solution that supports business processes like phase-based program management as well as document, file, and data control [such as Engineering Bills of Material and Parts Lists] plays an essential role in enabling Lean in product development. Key elements in an enterprise PLM software solution that supports Lean include:

Process Structure – Ability to define product development phases, milestones, and deliverables in formats that accommodate the many complexities of the business; Template driven processes that become the working version of a new product program are important to both standardization and productivity.

Visual Management – Ability to see the progress and status of product programs as they move through product development; Dashboards with real-time roll ups of actual project activities are important in eliminating waste due to misinformation and duplication of tasks.

Knowledge Management – Ability to capture, store, sort, and easily retrieve product information in a comprehensive context; Managing a single version of the truth in a controlled manner with meaningful relationships to associated information is critical to avoiding mistakes and achieving coordination.

Process Flexibility – Ability to easily modify business processes and information relationships to quickly adapt to business conditions; As opposed to the rigid nature of ERP and PDM systems, a solution that supports Lean in product development must be easily adapted to continuously improve.

Internet Based – True Internet based enterprise software enables communication, collaboration, and coordination without the limitations inherent in conventional systems; Software based on a modern Internet service-oriented architecture [SOA] also has a dramatically lower ownership cost.

Closing Summary

Today leading companies are seeking ways to achieve advantages in the marketplace by extending Lean strategies into product development to outmaneuver the competition. For a company to realize the full potential of a Lean strategy all groups across the organization must understand how Lean applies to their activities and what actions are required to deliver financial results.

The *Lean Development* approach provides companies with an effective way to begin the Lean journey in product development and engineering in a straightforward and un-intrusive manner which can deliver significant benefits in waste elimination and cycle time reduction with minimal risk of disruption or cultural resistance.

By applying *Lean Development* practices companies will incorporate Lean strategies in the product development organization improving future financial performance.

About the Author

Marc Lind is currently a Senior Vice President for Aras Corporation. Mr. Lind is a member of AME [Association for Manufacturing Excellence], APICS, and PDMA [Product Development and Management Association] and a graduate of the University of Massachusetts at Amherst in Operations Management.

About Aras

Aras Corporation offers the best Product Lifecycle Management (PLM) software for global businesses with complex products and processes.

Advanced PLM platform technology makes Aras more scalable, flexible and secure for the world's largest organizations, and a full set of applications provide complete functionality for companies of all sizes.

Aras solutions are designed to support Lean in the global product development process while addressing product quality, risk management, and compliance in an integrated manner.

Customers include GE, Honda, Motorola, Hitachi, Freudenberg, GETRAG, TEVA Pharmaceuticals, Textron and XEROX.



300 Brickstone Square
Suite 700
Andover, MA 01810
[978] 691-8900 Phone
[978] 794-9826 Fax
info@aras.com
www.aras.com

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