



Sigma Breakthrough Technologies Inc[®]

Lean Product Development™ Program

A White Paper by Dr. Ian Wedgwood

1. Abstract

This white paper is an introduction and overview of the Lean Product Development™ development program created by Sigma Breakthrough Technologies, Inc. A Lean Product Development™ program forms a cornerstone to any Lean Enterprise of Six Sigma initiative. The intent here is to provide the reader with a general understanding of the following:

- Overview of a Lean Product Development™ program
- Deployment requirements
- SBTI's approach to the Lean Product Development™ philosophy
- Comparison to Six Sigma
- Benefits of a Lean Product Development™ program
- Integration to current Operations
- Program Overview

Contact SBTI at 888-752-7070 or info@sbtimail.com to discuss an implementation or for specific program details.

2. Introduction to the Development™ Program

The Lean Product Development™ methodology can be considered to be the Lean equivalent of the widely adopted Design for Six Sigma. The simplified notion is to design quality and “leanness” into the product before it ever gets to the manufacturing floor where Lean/Six Sigma Black Belts are working. In the ideal world Lean Product Development™ Black Belts put Lean/Six Sigma Black Belts out of work. Lean Product Development™ Black Belts often work side-by-side with their Lean/Six Sigma counterparts, using their expert knowledge to solve process problems even before they happen.

Lean Product Development™ philosophy is more than giving your product development people some exposure to lean concepts: moreover it is the ground-up integration of lean methodologies into systems and product design. A Lean Product Development™ program begins with the disciplines of Business Planning to ensure the development path is not taken without a firm business case to do so. It then bring together key functions from the business to capture the “Voice of the Customer”, to translate this Voice into Customer requirements that in turn are translated into System & Product requirements. Later, these Product requirements are then translated further to Process requirements and Process control. Lean Product Development™ Belts understand the concept of product value (a ratio of features to price), and how to increase value by targeting precisely the features a Customer desires and reducing the Total Cost of Ownership by eliminating features which the Customer is not willing to pay for. By taking advantage of additionally identified low or zero cost features, the product becomes differentiated from those of the competition.

Lean Product Development™ Belts also learn how to make significant lean focused improvements to the manufacturability of products before the product ever reaches the factory floor. Lean considerations include:

- Platform-derivative design,
- Modularity,
- Ability to make in single piece flow,
- Reduction of manufacturing times and ease of assembly,
- Late configuration of products and order of assemble,
- Product rationalization,
- Removing curtain operations,
- Reducing of component part counts,
- Reducing complexity,
- Increased reuse of components across product families,
- Supplier leverage
- Inventory reduction,
- Making products robust to the variability in supplied raw materials,
- Built-in quality and reliability.

This allows production to be quicker, at lower cost and with lower levels of inventory, consistently wherever manufacturing sites are located globally.

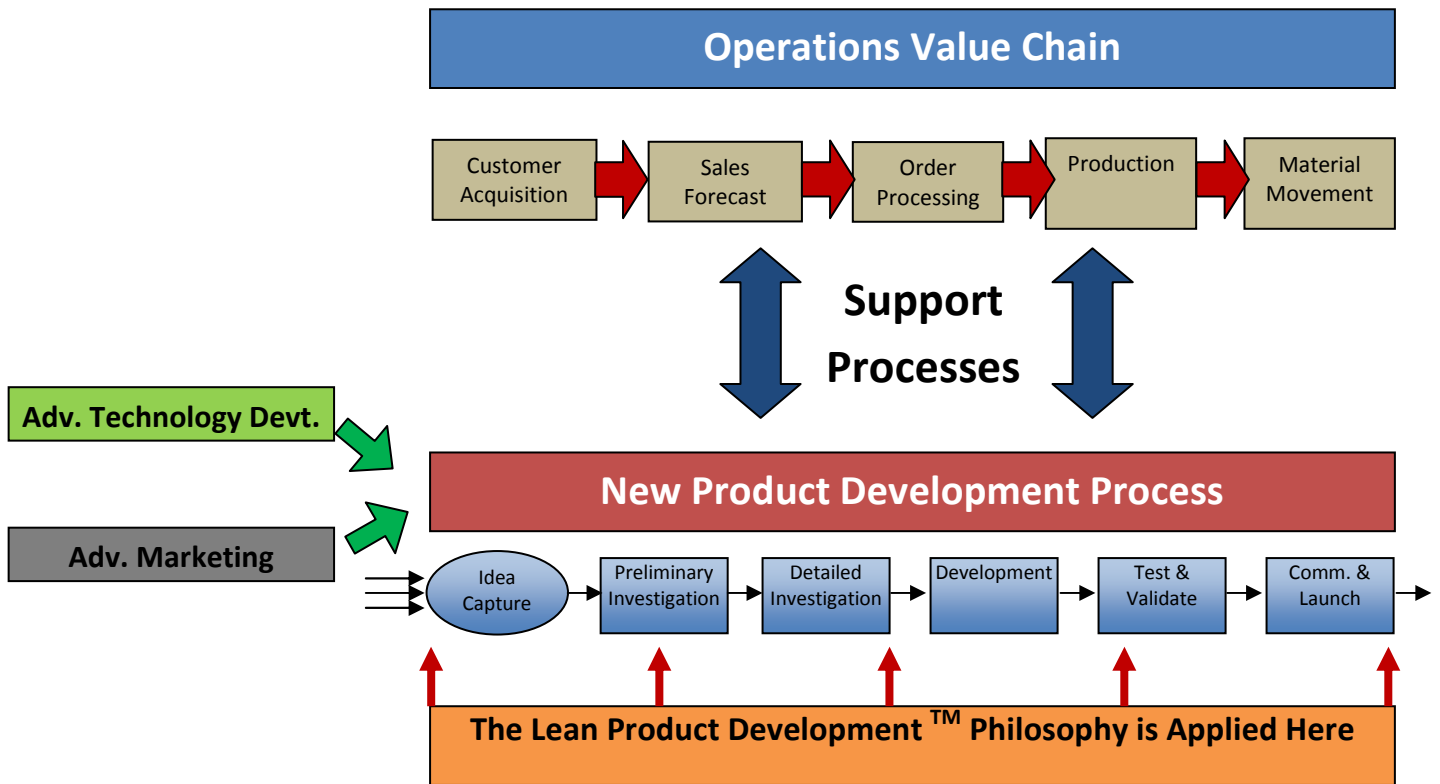


Figure 2.1 Improving the Enterprise

3. Requirements

- A Lean Product Development™ program includes the following:
- An improved toolkit for designer
- Designers know how and when to use tools
- Practical experience with Lean Product Development
- Strong discipline by the business to sometimes opt for additional effort to be expended during product development
- Strong cross-functional support throughout the product development process
- An existing Stage-Gate®¹ New Product Introduction (NPI) process in the business

4. Approach

The training approach is similar to that of Process Six Sigma and DFSS. Lean Product Development™ belts undergo 5 weeks of training carried out over 5 months. During the class time they learn the tools; when and how to use them. During the intermediate 3 weeks a month they are required to carry out a project using the Lean Product Development™ tools. It is also required that a Lean Product Development™ belt be part of a production Kaizen event to get a deeper understanding of the implications of design paths chosen. Their project is carefully chosen by a Champion within the business and obviously should be meaningful and of importance to the business. In general, Lean Product Development™ belts work projects on development that would have been on their desk anyway.

Thus the training and project provide the tools, the *how* and *when* to use them and practical experience in their use. The remaining items are the ongoing investment in DFSS that the businesses have to make; discipline to support the DFSS belt's work and strong cross-functional support throughout the product deployment. The final item, the Stage-Gate® process is key to the focusing of the project. DFSS projects are full development projects, but use data driven tools to ensure the product developed creates value for the customer, is easily manufactured and generates margins and revenue required by the business.

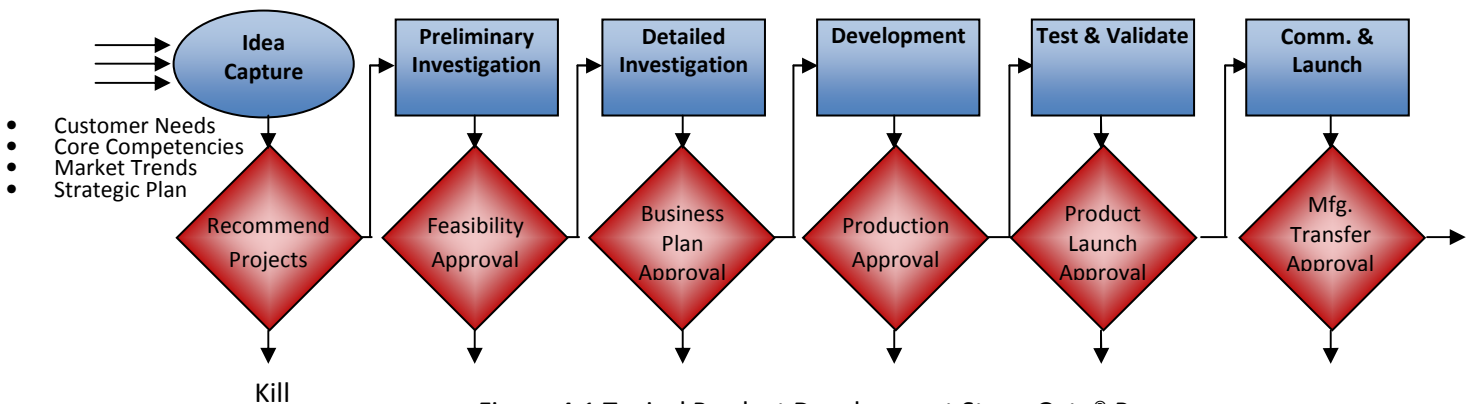


Figure 4.1 Typical Product Development Stage-Gate® Process

¹ Stage-Gate® is a registered mark of Product Development Institute, Inc.

5. How does Lean Product Development™ differ from Six Sigma?

Lean Sigma & Six Sigma target manufacturing and other business processes, whereas the Lean Product Development™ methodology focuses within the product development on a particular product. Lean/Sigma Black Belts are taken from their existing functions to become a “fire-brigade”, tackling problem processes. Lean Product Development™ belts tend to remain within their functions applying a stronger toolkit and design problem solving methodology.

Lean/Six Sigma Black Belts baseline an existing problem, solve the problem and can measure results with almost immediate effect. Lean Product Development™ belts may spend a significant part of their efforts in avoiding problems, often having no baseline to work with.

Lean/Six Sigma Black Belts projects quickly yield the corresponding benefits from their efforts. Lean Product Development™ belts often have to wait until a new product is launched (or at least piloted) before they see the fruition of their efforts. Even then, the benefit will be spread over the lifetime of the product.

Lean/Six Sigma Black Belts on average yield approximately \$250k benefits per project, whereas the impact of a Lean Product Development™ project can run into millions of dollars, e.g. if product cost is reduced by 1% and revenues increased by 1% over the life of a product.

6. Benefits

Benefits of undertaking a Lean Product Development™ program come from the following:

- Improved quality at product launch, because the product is more tolerant to variation in both the supplied components and the manufacturing process itself and has fewer raw material components
- Faster development time
- Increased revenue due to the product being perceived of higher value by the customer
- Reduced inventory costs due to fewer components and more re-use of components across products i.e. fewer unique parts
- Reduced assembly times because the product has fewer components and those that it does have are easier to manufacture

Reduced products cost by better selection of material and manufacturing process

The above benefits will be large, but are inherently difficult to measure (they are not independent of a host of other variables affecting product success). The recognized standard for return on the investment in a Lean Product Development™ program is 2x over the short term, 6x medium term and 20-100x long-term (Source: SBTI, Invensys, GEMedical and Toshiba). These figures may seem large, but put in the context of an average product introduction where the sensitivities are typically:

- 1% development expense over-run: \$26k-\$135k

- 1% product cost overrun: \$300k-\$2.1m
- 1% sales sort-fall: \$1.3m-\$3.1 m
- Cost of 1 day delay: \$28k-\$750k

Alternatively framing benefits in the context of a corporation as a whole where product sales are \$XXm annually with COGS at \$XXXm a 1% swing in favor of higher revenue and lower cost return is measured in millions of dollars annually.

Components of Lean Design	Cost Benefits													Revenue	Other			
	increased product robustness	increased RTY	product cost reduced	inventory reduced	development expense reduced	assembly time reduced	assembly operations reduced	assembly complexity reduced	assembly training reduced	reduced shipping costs	reduced warrantee costs	reduced service training	reduced fixed R&D costs	number of suppliers reduced	increased product desirability	development time reduced	corporate image	builds people
fewer parts per product	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓				
fewer unique parts per product	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓				
reuse of parts across product families		✓		✓	✓										✓			
wider tolerances	✓	✓				✓					✓			✓				
ease of assembly	✓	✓				✓		✓	✓			✓						
mistake proof assembly	✓	✓				✓		✓	✓		✓	✓						
lower weight/volume	✓	✓				✓		✓	✓	✓				✓				
fewer unwanted features	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
more wanted features														✓		✓		
cross functional involvement					✓							✓		✓	✓			✓
fewer redesigns	✓	✓			✓							✓	✓		✓			
more simulation / less hardware cycles					✓								✓		✓			
better selection of materials	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓				
late configuration of product	✓	✓		✓				✓			✓							
improved innovation techniques													✓		✓	✓		
product rationalisation	✓	✓		✓	✓			✓				✓	✓	✓	✓			
project experience																		✓
tool training																		✓
focus on business benefits			✓	✓	✓										✓			
just doing Lean Design																	✓	

Figure 6.1 Table 1 – Relationship between the components of a Lean Product Development™ Program and the benefits to be gained

7. Embedding Lean Product Development™

As mentioned in the Introduction, a Lean Product Development™ program is resourced differently to process Lean/Six Sigma. Lean Product Development™ Black/Green Belts remain within their functions tackling problems within product development projects, effectively those problems that would have been on their desks anyway. There is also a need to have a higher proportion of Lean Product

Development™ belts within the business; at least one Black Belt per product development project is considered a bare minimum and maybe 50% or more of Engineers would be at a Green Belt level. Clearly this type of investment cannot occur overnight and it is therefore necessary to lay down an implementation plan at the business level, outlining the targets for participants, their expected return and the scheduled of attendance

A Lean Product Development™ program can be considered in a similar manner to the notion of “World Class” – it is a road of continuous improvement and there are always advances to be made. The current position at most companies is that they have very large opportunities for improvement in terms of cost savings but more importantly in future revenue growth.

8. Program Overview

The main bullets below describe the course section. The second level bullets below summarize the modules taught to master the respective section. (Contact SBTI for a detailed course agenda)

- **Business Case (understanding the market)** - Necessary components to ensure the project is viable before commencement.
- **Concept Engineering (understanding the customer)** – Necessary components to capture the Voice of the Customer™ and convert it to System & Product requirements
- **Lean Concepts** – Necessary components to ensure Belts understand the target outcome in manufacturing
- **Platform / System Architecture** – Necessary components to build leanness across product families vs. designing products in isolation
- **Introduction to Statistics** – Necessary components to allow Belts to understand upcoming statistically based tools
- **Understanding manufacturing** – Necessary components to gain an understanding of the current state of manufacturing and the key drivers for variability in the process
- **Product Design for manufacturability** – Necessary components to ensure product is easy to assemble and adheres to lean needs of manufacturing
- **Optimizing the product** – Necessary components to improve the performance of the product from prototype to pilot
- **Moving to capable manufacturing** – Necessary components to scale up a product into production

There are 5 levels of attendance to the course:

- **Executive** – attends 1 day of training at the launch of initiative to understand Lean Product Development™ concepts and philosophy, and how to drive it in the business. *Typical attendees are the executives and senior business leaders.*
- **Champion** – attends 3 days of training prior to first week to learn what to expect of their Black / Green Belt(s) and how best to support them. *Typical attendees are the managers of the initiative and Black Belt/ Green Belt mentors.*

- **Black Belt** – attends all 5 weeks of training and is required to complete a project. *Typical attendees are the project team leaders.*
- **Green Belt** – attends all of the first 3 weeks of training. A green Belt learns to an intermediate level of the Lean Product Development™ curriculum and is required to complete a project. *Typical attendees are the project team members.*
- **Week 1** – attends the whole of the first week of training to understand the concepts central to the Lean Product Development™ philosophy along with tools to strengthen the early stages of the NPI process. *Typical attendees are member of the project teams and anyone in the company affected by the projects.*