

Complexity Reduction

Managing the complexity of global product development to enable component reuse

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This article is based on a study of one of Sweden's largest developer of consumer electronics. The purpose of the study was to analyze the complexity of global new product development and discuss how this complexity can be reduced through standardization and component modularization.

Keywords: Modularization, standardization, new product development, purchasing, process, value analysis and knowledge management.

1. Introduction

With more and more western companies pushing manufacturing and routine IT activities to Asia it is becoming more and more evident that the new frontier of sustainable success is product development. Interesting to note, taking the automobile industry as an example, is that while the number of unique vehicle platforms has decreased, the number of vehicle models available to the consumers has increased dramatically. This is due to the fact that most consumer driven companies have been forced to speed up product development in order to give the consumer what they want, when they want it. It is not enough to produce yesterday's product in a super efficient way.¹ Many companies have had too much of a "tech push" orientation for their new product

development and need to realign their development towards a "market pull" orientation.² The author of this article argues that many large companies need to learn how to leverage its product offering to improve its value creating capabilities, having a large number of products, built with material from a large number of suppliers and selling them to a large number of customers is complex. The author argues that by standardizing processes and material, a company will be able to increase its ability to manage this complexity and hence increase its speed and agility in delivering the right product to the right customer. Companies must learn how to use standardization to spread knowledge and best practices and hence increase their learning capabilities.

Chapters 2 and 3 will briefly introduce the purpose of the study that this article is based on and the methodology used to collect and

¹ Morgan et al. (2006)

² Cooper (1990)

analyze data. In chapter 4 the most critical learnings from the theoretical framework of the study are presented. Chapter 5 and 6 will then conclude by presenting the findings of the study. The article ends with a short summary.

2. The study

This article is based on a study of the new product development process of one of Sweden's largest developers of consumer electronics. The purpose of the study was to analyze the complexity of global new product development and discuss how this complexity can be reduced through standardization and component modularization.

3. Methodology

The study was conducted as a qualitative single case study. Data was mainly gathered using personal interviews, internal data and studies of relevant literature. Literature studies resulted in a comprehensive theoretical framework for understanding the complexity of new product development. Two different rounds of personal interviews were performed. A total of 16 interviews were performed with respondents from product planning, industry design, research & development and procurement. This data was then analyzed and compared to the theoretical framework to identify non-value adding complexity and draft suggestions for improvements.

4. Theoretical framework

Many companies need to improve their capabilities for developing and launching new products, not just extensions and incremental updates, but new innovative products that deliver sustainable competitive advantage to

the company.³ The study approaches new product development from three different perspectives, namely from a Lean Product Development System perspective⁴, from a Process perspective⁵ and from a Project perspective⁶. Important to realize is that these three perspectives on new product development represent different levels of abstraction for which new product development can be approached. A lean perspective deals with the balance between process, humans and technology⁷ (Figure 4.1).

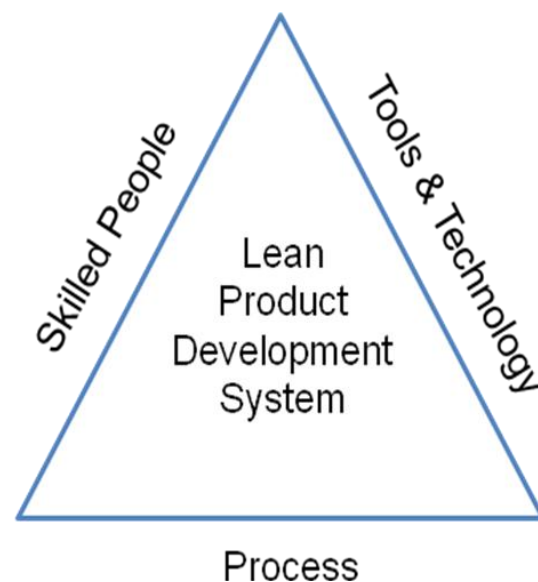


Figure 4.1 Lean Product Development System

³ Cooper (1990)

⁴ Morgan et al. (2006)

⁵ Cooper (2008)

⁶ Pons (2008)

⁷ Morgan et al. (2006)

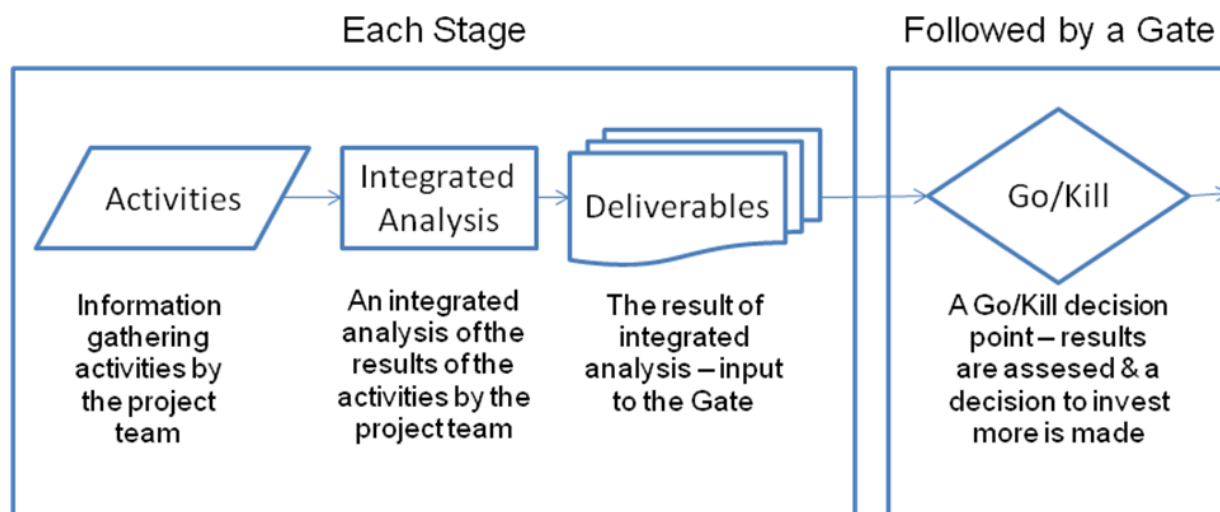


Figure 4.2 Framework for a new product development process.

The purpose of a new product development process is to deliver the right product to the right customer every time (Figure 4.2). Product development would of course be possible without a detailed process but having a good process has two main benefits. It gives you a level of confidence that the result of the process will in fact be the “right” product and it ensures that you will be able to repeat this accomplishment. If the process is a road leading from market demand to customer satisfaction then the project is a car driving on that road. As a real road the process will need to be maintained so that a car/project will get from start to finish in as safe and speedily fashion as possible. It is sometimes possible for a car to find shortcuts but normally the best way to reach your destination is to stay on the designated road.⁸ Since the study is written from the perspective of the purchasing department, the area of purchasing involvement in New Product Development is studied. It is today widely accepted that involving suppliers in product development can lead to shorter lead time, lower costs and

⁸ Ljungberg et al. (2001)

enhance quality. It is however important to stress that procurement needs to be involved on both a strategic a operative level. The strategic level includes managing long term supplier relationships to better leverage the capabilities of the company’s supplier base. The operational level means selecting the most suitable supplier and making make or buy decisions.⁹ The study further studied Modularization¹⁰ and Value Analysis¹¹, tools that in combination are believed to have the role of a catalyst in reducing non-value adding complexity. Modularization is a way to manage variety. Important to realize is the difference between internal and external variety and that it, using modularization is possible to have external variety even though the internal variety is standardized (Figure 4.3)¹². Value analysis is a systematic method for analyzing all

⁹ Wynstra et al. (1999)

¹⁰ Erixon et al. (1997)

¹¹ Kendt et al. (1992)

¹² Blackenfelt (2001)

components to determine if their function can be performed by a cheaper solution.¹³

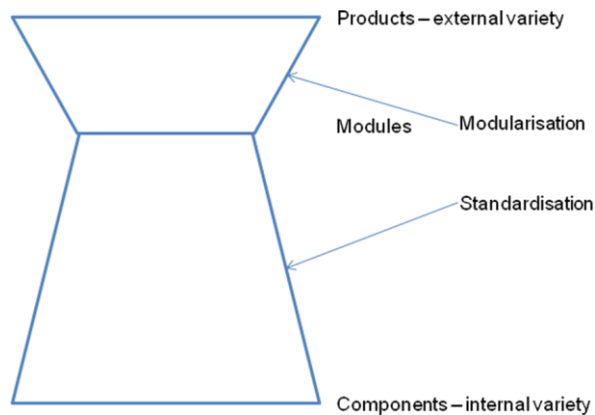


Figure 4.3 Illustration of the difference between internal and external variety.

The area of Knowledge Management is intended to facilitate the sustainable repetitiveness of New Product Development. Many argue that an organizations ability to learn and adapt is in fact the only sustainable source of competitive advantage in today's economic environment¹⁴

5. Drivers of complexity

The study identified three drivers of complexity, product silos, functional silos and a general distrust for standardization. A driver of complexity is an activity or a cultural aspect that drives complexity more than it drives value. The author uses these three drivers of complexity to describe the complexity observed by the study.

Product silos

In the studied company, individual projects are measured based on their ability to reach the target profit margin for their project alone

giving them almost no incentive to consider how their decisions impact the whole product portfolio but very large incentives to minimize their own direct material costs. This will lead to late engineering changes in the final race towards a target profit margin that does not consider the company's total spending. Late engineering changes have a clear impact on quality and cost reducing activities should instead be performed much earlier in the form of systematic value analysis

Something that is deeply embedded into the company's culture is that all products should be unique. This drives focus towards developing individual products instead of developing a well balanced portfolio of products and could further be interpreted as if there is nothing at all to learn from previous projects. This is a big barrier for effective multi project management.

Functional silos

In the studied company, there is some misalignment between the planning horizons of different functions. The result of this is that any real technological differentiation from their competitors is very difficult. It is of crucial importance for the long term sustainability of the product portfolio that planning horizons are better aligned to support strategic development of important technology and a holistic management of this area is required.

The study contains several signs of bad communication, lack of understanding of how other functions work and assumptions about what other departments seem to think. This is a significant problem when trying to reduce complexity and increase standardization as this is something that requires holistic planning and support across several different functions.

¹³ Kendt et al. (1992)

¹⁴ Chang et al. (2008); Pitt et al. (2008); Donnellan et al. (2004)

General distrust of standardization

Henry Ford once said that,

"if you think of standardization as the best you know today, but which is to be improved tomorrow – you get somewhere. But if you think of standards as confining, then progress stops".

The study shows evidence that designers and engineers see standardization and modularization as constraining and limiting the creative development of new products. The author however, argues that standardization would enable the engineers to develop even better products as it makes it possible to embed best practices and lessons learned into the new product development process. Modularization is the management of variety, not the limitation of variety.

6. Managing complexity

The study identified 9 different management areas that can be used to manage the three drivers of complexity and reduce the complexity of new product development. These are:

- Aligning planning horizons
- Global coordination
- Cross-functional communication and knowledge
- Project implementation
- Procurement as a facilitator in new product development
- Enable modularization
- Long term strategic technology development

Aligning planning horizons

The goal for aligning planning horizons is that all departments should have the information that is required for them to perform their activities in the best possible way. Predictions should be

made by as few people as possible and be in line with the overall strategy. If this lack of clear information is pushed down through the organization the result will be thousands of highly detailed assumptions. The first step in achieving aligned planning horizons is to decrease the lead time of new product development. The second step is to make sure that departments are in alignment and can deliver sufficient information in order to identify and develop what technology will be needed to maximize the value of the future product portfolio.

Global coordination

In a global organization with product development all over the world, resources should be coordinated on a global level. This is important in order to maximize the utilization of available resources in a cost effective way. Product development projects should be coordinated holistically to enable identification of opportunities for projects to share components or resources. The development of global design guidelines would make it possible to spread best practices of how products should be designed for increased commonality and reduced complexity.

Cross-functional communication and knowledge

An increased understanding of how other functions work would give incentive to perform your own work in a way that makes it as easy as possible for other functions to perform their work. Having a common vocabulary for quality would lead to improved general quality of developed products as it would make it easier for people from different functions to discuss quality related issues.

Project implementation

Cost targets that only focus on direct material price is a large barrier for component modularization. The current solution for covering indirect costs is not an optimal way to measure cost as it is deeply lacking in transparency and gives no incentive for reducing indirect costs. Using a total cost perspective is probably not more accurate but what it lacks in accuracy it makes up for in transparency.

Procurement as a facilitator in new product development

It is very important that both strategic and operative Procurement activities are performed. Procurement has the responsibility to drive commonality and reduce the cost for direct material. The study shows little trace of any long term strategic collaboration with suppliers. Strategic collaboration would increase the possibilities to develop components that are better customized and open up for the development of new, unique technology.

Enable modularization

Modularization is an integrated part of complexity reduction as it is focused on developing modules that can be shared between several different projects which is what complexity reduction is all about. The analysis identifies two areas that the author argues should be given special attention. Efforts are needed to divert focus towards developing a well balanced portfolio and increase the understanding of how modularization can help increase external variety.

Long term strategic technology development

In order to sustain the future competitiveness of the product portfolio companies need to focus on disruptive technology development that can lead to increased competitive advantage. Long term strategic technology development will make it possible to better leverage the technological capabilities of a company's suppliers through strategic partnerships and supplier involvement in new product development. Any product developing company regularly needs to justify what will be the "new" in their new product development.

7. Summary

This article is based on a study of how the complexity of global new product development of one of Sweden's largest developer of consumer electronics can be reduced. The study is supported by a theoretical framework presents a number of different views on new product development and how procurement could and should be involved in new product development. The theoretical framework further presents a toolbox containing modularization, value analysis and knowledge management. One of the key messages is the difference between internal and external variety and how modularization can be used to maximize the external variety while minimizing the internal variety. The conclusion of the study is 9 different management areas that can be used to reduce the complexity of new product development.

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