

Society of Manufacturing Engineers

Management Forum

Beyond Lean:
Product Lifecycle Management from Design
to Disposal

A Systems Approach to Managing Product Lifecycles

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Thank you, Noel. I'm really excited to be here to talk with you today about a systems approach to managing product lifecycles. Now that Dr. Grieves has defined product lifecycle management, I decided to talk about the larger paradigm of managing products as large systems over time, which I think is the underlying theory that supports product lifecycle management. I'm also going to talk about the history of the concept of systems management of products, and how I think product lifecycle management fits into a systems view, today.

Looking at manufacturing as a system was perhaps first described by Dr. W. Edwards Deming to the manufacturing community in Japan in 1950. Since that time, there has been an increased understanding of systems thinking applied to all the elements of product design, engineering, manufacturing, marketing and other elements of a product's lifecycle management. This morning, I want to explore product lifecycle management as a systems scientist would, by looking at product lifecycles as systems and ensuring their elements as well as their interdependencies are understood. We'll also talk a little about a few of the business implications of systems thinking for the management of products in companies.

For fourteen years, I had the privilege of working with Dr. W. Edwards Deming. Many people, today, think his fundamentals are passé, but I don't agree. Although he

never used the phrase “Product Lifecycle Management,” Dr. Deming may have been one of the first practitioners to understand the foundation of lifecycle management as we define it today; the need to give all the customers in the value chain what they want, when they want it, in a cost effective way and with an idea toward its ultimate use or reuse.

In Dr. Deming’s original “production as a system” diagram, that he first drew for Japanese industry in 1950, in his famous Thursday evening, July 13th lecture that year, the customer is prominently featured and everything is aimed at giving the customer satisfaction. Increasingly, customers need to be understood as are all stakeholders, including the society in which the company, customer and product are a part. Products are viewed holistically by getting out into the next larger system and seeing the whole. Most often, products are best viewed by getting out two systems or more to see the impact the product has on the company that produces it, the user who purchases it, the government that regulates it, and ultimately the overall society that eventually disposes of it or recycles it for reuse. This was true in Dr. Deming’s mind even before the 1950’s as he worked with Western Electric and the old Bell System to develop products that would be able to last a hundred years!

Dr. Deming’s Plan-Do-Study-Act, or P-D-S-A cycle, based upon Shewhart’s model was not just a statistical concept. It

was relevant for any process needing improvement, including the management system.

Dr. Deming believed in the idea that you need on-going feedback from the customer in the broad sense including all stakeholders to produce products through a process that he called “design and redesign” for customer satisfaction. It’s at the core of product lifecycle management. Another major element of lifecycle management is Dr. Deming’s ideas about driving all waste out of the system to improve quality and to go “fast.” These are also incredibly relevant to the ability of companies to develop and produce products and services using product lifecycle management.

In fact, I think that companies who are able to embrace and apply Dr. Deming’s theories are the companies who are best able to apply the ideas of product lifecycle management. Starting with Toyota, clearly the company that most completely embraces the ideas of Dr. Deming, I think all companies may want to review some of his basics before they begin the journey to product lifecycle management.

If you think about product lifecycle management as it is today, it is all about meeting the unique needs of customers, and all stakeholders within the system, by design, but, in the midst of today’s world, which is extremely turbulent. I think we all know just how much turbulence we are all living in – market turbulence, broader economic turbulence, political turbulence, and so on. And by

turbulence, I mean change on a massive scale. And, the changes that we live with, today, are accelerating. When I realize that when I went away to college as a physics major, my Dad gave me a slide rule, and my kids wouldn't know what to do with a slide rule if their life depended on it. Well, imagine the changes in technology in Dr. Deming's life-time. Born in 1900, and ultimately trained as a classical physicist, Dr. Deming was studying while Albert Einstein's theories of relativity were first being debated in the physics community, and then Heisenberg's uncertainty principles were being published. Dr. Deming was born just three years before Orville and Wilbur Wright flew their first plane at Kitty Hawk and he lived to see men walk on the moon, but not to see the internet, laptop computers and Blackberry and Palm pilots rule the day.

If Dr. Deming were alive today, I think he would have considered product lifecycle management in direct accord with his thinking. The only difference might be "by what method" do you meet the unique needs of customers in the broadest sense across the value chain from beginning to end and beginning again? But, I am not convinced that our ideas of lifecycle management are a different paradigm than Dr. Deming's original ideas of lean production as a system to meet the needs of the customer regardless of who the customer is, including society at large.

The world that Dr. Deming lived in did not have the kinds of tools that we possess today. When Dr. Deming died in 1993, we as a society were just *beginning* to utilize the

internet in our daily work lives. We were just *beginning* to evolve into math-based systems for CAD/CAM. It seems like ancient history when I think about my work using computers just ten years ago. I didn't even have an email address! Did you? I was using voice mail, but did not use web-based tools, at all. The electronics revolution that has occurred in the last decade since Dr. Deming's death permits us to manage very large complex systems including the use of nonlinear dynamic tools, not to mention the advances in other related technologies that support the global reach of satellite based design and management tools...the tools of product lifecycle management.

So what do I think the methods will be in the next few years. What will it take to make product lifecycle management work? I think it will take a minimum of four things.

First of all, it takes a product lifecycle vision of what the company is trying to accomplish. A visioning process will need to be used to develop and articulate the vision to the entire organization because the whole organization needs to participate in the transformation to product lifecycle management in order for it to be a success.

The internal environment of an organization is very important to define since it's the heart of the system. Every executive should understand the forces at work inside their system, if they are going to be able to think through product lifecycle issues.

The product lifecycle vision requires answering many questions. This includes an understanding of the people of the organization and how well they work together, as a team, to accomplish the work of the organization. What business is the organization in? Will it even exist in the future? Will it be obsolete? Is it profitable? Is it competitive? Is the organization structured effectively and efficiently to accomplish work or is the structure a barrier? What are the functions of the organization? How well do they work together? What is the organization's overall process capability? Is it measurable? What about process integration, that is, how does the process of one function interface with the process of another?

How do you answer all of these questions in a way that will transform the organization from a traditional product development and manufacturing process to a process that looks at total product lifecycle management and all that that entails?

A critical element of the internal environment is the culture of the organization. How would it be characterized? Is it a positive force for change in the organization or a barrier to change? Are there formal, written statements of beliefs and values? What does the company stand for? In a product lifecycle management environment, what in the culture will need to change?

How are decisions made? What is the resource allocation

process? How does the organization invest in its leadership for future generations? What is the infrastructure that supports the entire organization? What are the organization's unique core competencies that separate it from others? Who is the customer? Who will they be, tomorrow? Do you know the answers to these questions, today? How will all of these questions be answered differently in a world in which product lifecycle management exists?

What will the world look like in the future? And, how will your company fit into that future? What will it take to make your company successful at total product lifecycle management?

These questions and their answers are at the heart of visioning for a product lifecycle world. No matter how you look at it, you need a vision and a plan to implement it.

Secondly, product lifecycle management requires methods as part of the plan. I think there are at least five primary ways, but I suspect that there are an infinite number of ways, and only the imagination and ingenuity of you and your people can limit what is possible, since you know your customers and products and services better than anyone else. Mine include:

- Understand your system's inputs, outputs and throughputs
- Understand every customer's needs throughout the

value chain

- Understand the impact of the value chain on the next larger system, and its next larger system
- Provide quick response throughout the value chain
- Use network solutions to manage the system complexities

This requires an understanding of the entire value chain to determine innovative ways for the product to come together and ultimately be taken apart that are better, faster, cheaper and with infinite variety.

The third thing that product lifecycle management requires is a strategy to transform the organization. Because total lifecycle management is a complete management system, the means to change the organization from its current state to one that manages the lifecycle of a product is more than an evolution. It's probably a revolution touching every function in the organization and all of the cross functional processes in the company. It's more than business process reengineering, though some of those techniques could be useful for the changes.

Finally, if you have a strong vision of what you want to accomplish, methodologies to develop lifecycle management of your product or service, organizational strategies to re-think the management system of the company, and a plan to implement it all, you have a chance for transformation *if, and only if you have leadership.*

Total product lifecycle management is more than a frame of mind. It takes leadership that's willing to admit they don't know all the answers, and are willing to learn how to change the way they manage the company. This isn't easy because going from a traditional product development process to total product lifecycle management requires massive change, and that requires learning new knowledge. With all the work trying to design and implement "learning organizations," à la Peter Senge, the truth is that many corporations' cultures do not value learning or the knowledge it brings. Most of these organizations have not developed processes to share and use new knowledge acquired essential to implement total product lifecycle management, but they must to be successful. This requires an attitude that there is a need to change, and senior leaders may not know exactly how; they may have to admit that they don't have all the answers. Sometimes, that's very difficult for executives to accept. It's what Senge's group calls getting out of "knowing" and into "learning."

Let's look at a couple of examples of product lifecycle management as a system. The standard of the world is probably the Toyota Production System, which today has evolved into a total lifecycle management system. Their system is probably the most mature in the auto industry. It has taken Toyota 53 years of evolution to get to this point, but they are the best at it in terms of their quality and profitability. Their knowledge of systems, learning and leadership is enormous. Today, Toyota has the wherewithal to purchase General Motors, Ford, and

DaimlerChrysler! They certainly are doing something right.

But, let's take another example a little closer to home. General Motors in an effort to accelerate its need for new knowledge created an R&D project to explore innovative ideas around product development using a systems approach. Major elements of the system examined include processes, people and economics. Functions contained in the categories that are interdependent include:

- Organization
- Coordination
- Phasing
- Enabling
- Rewarding
- Recognizing
- Staffing
- Feasibility
- Financing
- Budgeting
- Accounting.

Lessons learned from other industries are captured to see their relevance to GM's product lifecycle management process, and the learning cycles at GM are accelerating.

No matter how you analyze or synthesize the issue, product lifecycle management is here to stay. Open architectures

for design, assembly and disassembly, global standards, modularization, global electronic design and engineering tools and increasingly sophisticated electronics will all accelerate the systems approach to product lifecycle management in the future.

I don't think Dr. Deming would have been surprised. His question would be, "what is your plan to get there?" and "by what method?"

Thank you.