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White Paper

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GreenPLM

Going Green the PLM Way

Series 1 of 2

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Abstract

Designing green products is no more a value add-on especially in the Apparel industry. Also, the lack of standard Green laws and regulations across the globe in Apparel industry is not making it mandatory for organizations to design eco-friendly products. Product Lifecycle Management has evolved into GreenPLM by incorporating and managing the green product development and lifecycle. This paper provides a new perspective and a framework on green product development for Apparel companies as they plan to develop green products.

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June 2009

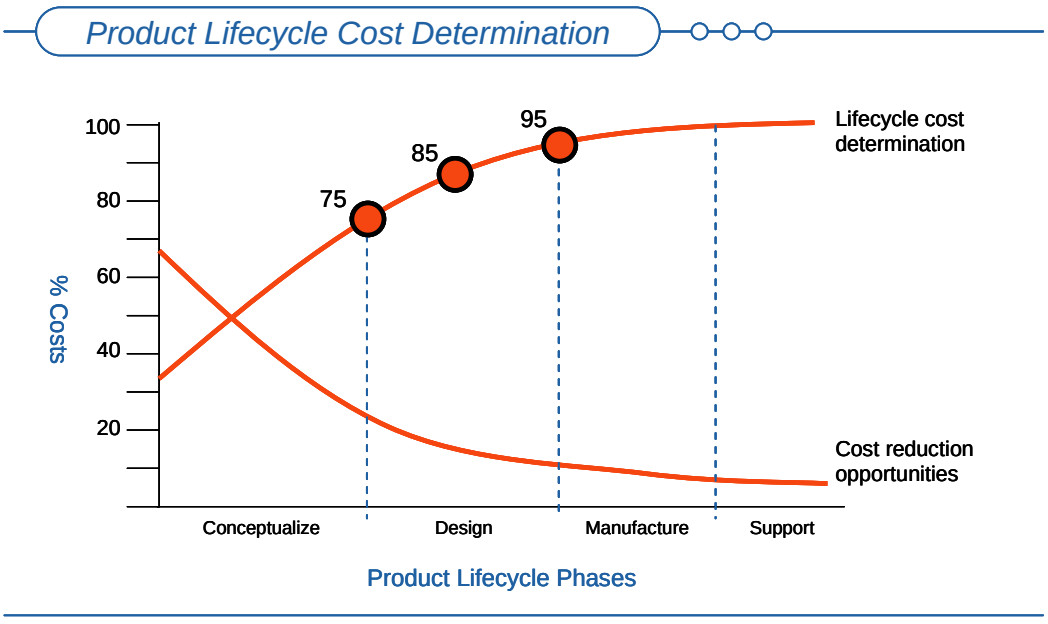
Introduction

Going green is more than just a trend; it is about being connected to the planet. Today, more and more organizations in various industries are adopting an eco-friendly approach to business and designing products the green way. The reason is simple: Not only does this make business sense but government regulations in their industry are also putting pressure on organizations to conform to environmental demands. These regulations include European laws such as the Extended Producer Responsibility – also known as the Take Back Legislation, 2006 – and others such as the Restriction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE).

With this sea change in the rules of the game, it is imperative that organizations take a holistic view of green product development rather than a limited view of individual development phases. At present, the emphasis is varied. While some companies are stressing on putting their green plan into action at the initial design stage, some others are doing so at the supply chain stage, and yet others at the End-of-Life (EOL) stage. The take-back laws have shifted the focus of organizations toward EOL management. However, the possibilities of developing green products and accruing cost benefits from them lie in the initial phase

According to AMR Research, 75% of a product's cost is determined during the concept phase. Figure 1 illustrates that cost can be controlled and managed right from the concept stage. It also implies that new initiatives, knowledge of materials, processes, and last-stage activities can be driven and controlled here.

Figure 1: PLM Phase wise Cost Breakup *Source: AMR Research 2003*



Product Lifecycle Management (PLM), especially GreenPLM, can be of immense help in this endeavour. As a technology-enabled approach, PLM has been helping organizations define, design and track products in their extended enterprise. It has now evolved to incorporate and manage green product development and lifecycles.

PLM follows a phase-wise approach to product development with product information maturing with each phase. Not only does it have an impact on control of information but tracking the same also becomes imperative. With product lifecycles becoming more and more compressed, the complexity of managing product information has increased in an extended enterprise environment.

PLM has been a strong enabler of the Design for Environment (DfE) program and has evolved into GreenPLM. DfE can be defined as an approach to design products more responsibly keeping in mind the impact they have on the environment. GreenPLM can be defined as, “A process-oriented, tool-based approach to design and deliver environment friendly, non-hazardous products using low-energy processes throughout the product’s lifecycle, leveraging PLM.”

However, it is important to understand the difference between the focus areas of DfE and GreenPLM. DfE’s scope encompasses many disciplines, including environmental risk management, product safety, occupational health and safety, pollution prevention, ecology and resource conservation, accident prevention, and waste management. The scope of GreenPLM, on the other hand, is confined to green product development, which in turn supports DfE. Thus, GreenPLM is a tool-based approach for DfE.

GreenPLM products cannot be disposed of the moment they reach their end-of-life stage. They have to be dematerialised, de-manufactured, recycled, reused, and the energy recovered before they are finally identified for disposal. There has been a paradigm shift from conventional PLM to GreenPLM and the way industry works.

Figure 2 below represents the evolved view of GreenPLM as perceived and followed by organizations today:

Figure 2: PLM Evolved View – GreenPLM Cycle

Based on: Bras B, 1997 “Incorporating Environmental Issues in Product Design & Realization, UNEP/IE – United Nations Environment Programme (Invited contribution), Vol. 20, No. 1-2 (double issue) pp7-13

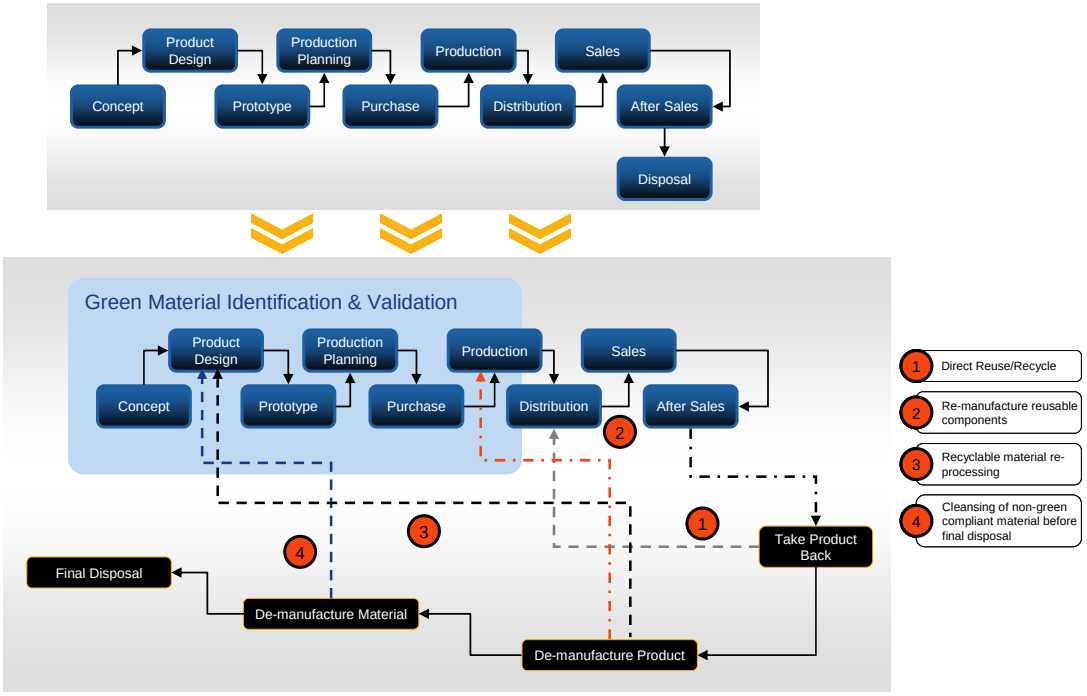


Figure 2 is based on the Bras B, 1997 framework and discusses PLM's evolution into GreenPLM. The Bras framework discusses the identification and use of green materials right from the concept phase. The green definition matures with:

- Design
- Proposition of green production techniques
- Environment-friendly production alternatives/substitutes
- Producer's responsibility to take the product back and dispose of it efficiently

Various Industries have changed their focus from "Concept to End-of-Life" to "Concept to Re" (recycle, remanufacture, redesign, rethink), especially the Apparel industry.

Apparel companies are using recycled polyester (from plastic bottles) and Cocona (activated carbon from coconut shells) to create performance apparel. The same is true for Footwear, worlds leading Footwear companies products are made with more efficient design patterns that use less material and are easier to recycle, adhesives made from water instead of toxic chemicals, and sustainable items like cork and organic cotton.

Some individuals may argue that "Re" part of "Concept to Re" (recycle, remanufacture, redesign, rethink), when one refers to apparel really doesn't exist. For them recycle means second-hand clothing, which is typically sold to third-world nations or passing the product to charities (or younger siblings) until they become rags, at which point they are used as, well, rags.

This is not true, recycled fabric apparel from synthetics may not be able to decamped but they can be recycled again as an industrial nutrient to feed the production of more recycled garments, also cotton clothing can be recycled back into fluff, which is then spun into new yarn. Recycling in the apparel industry is very limited and not well adopted as compared to High –Tech & Discrete manufacturing due the lack of regulations.

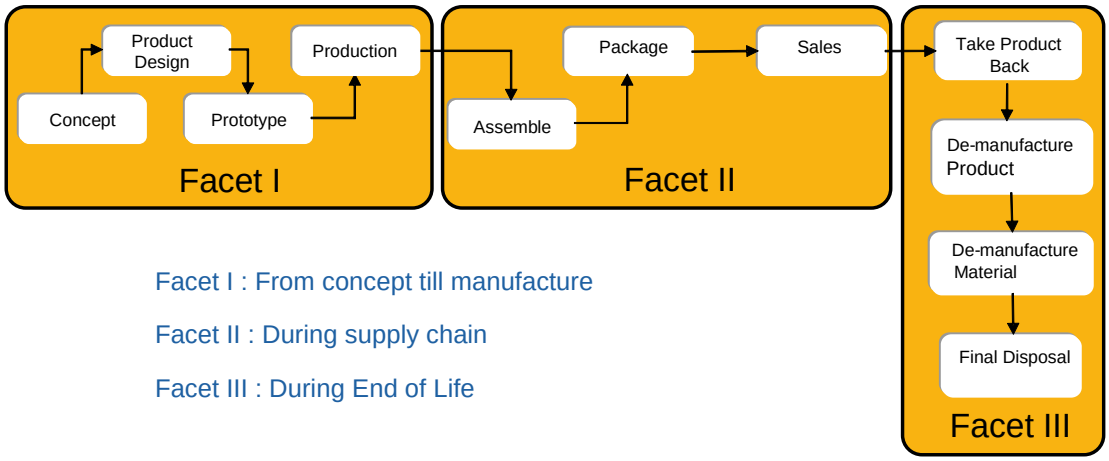
Facets and Challenges of Green Product Development

Figure 3 represents a simple view of green product development which has been divided into three facets. Highlighted are the phase-wise green-compliant product ratings and the cost associated in making the product green. A closer look reveals that Facet 1 has the highest potential to control factors impacting green compliance. Thus, it is economical to control cost at this facet. After the product is out in the market, various regulations come into play and the EOL phase is an expensive process.

In Facet I, while evolving the product design, the designer needs to consider materials, green regulations, environment impacts, ergonomics, ease of manufacture, and assembly of products,. Also, with many variants of the product available today for the consumer, the amount of information and management of the same till final disposal, adds to the focus.

In addition, the number of Engineering Change Notes (ECN) a product is associated with is huge and every ECN needs to be tracked and managed. PLM as a tool helps organizations manage such information. However, the addition of green aspects has widened the scope of the challenge.

Figure 3: Facets of Green Product Development



Facet I : From concept till manufacture

Facet II : During supply chain

Facet III : During End of Life

	FACET I	FACET II	FACET III
Characteristics	• Design and material information available • Production techniques finalized • Collaboration • Compliance information available	• Packaging and labeling defined • Logistics & transportation methods agreed	• Re-usability • Re-manufacture • De-materialize • Energy recover • Shredding • Final disposal
Green Compliant Product Controlling Rating	High	Medium	Medium
Cost Involved to meet green compliance	Less	Medium	High

Given below are the challenges faced by designers:

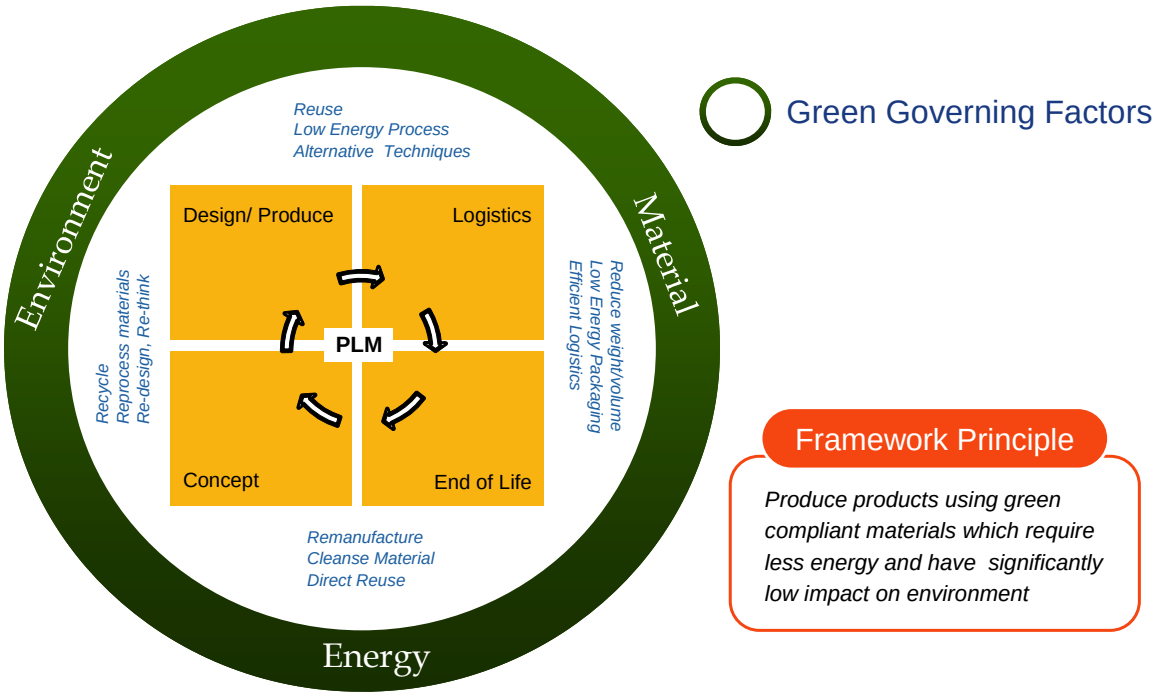
	Challenges
Facet I	Availability of green information in multiple systems, some of which are built on primitive technologies
	Each market has different green-compliance requirements. Thus, product configurability and variant management become a challenge
	Limited or no means of comparing various green designs to identify the optimal one which has less impact on the environment
	Scattered information on going green results in chaos, confusion and iterations
	Limited or non-availability of cost-impact information while the designer devises a component with green materials
Facet II & III	Availability of green-compliant material information at part level. So checking huge assemblies for green-compliance ratings is a complex issue for a designer
	Reporting/ dashboard information about green compliance at the product level is either non-existent or has not matured
	No clear identification and information about the availability of the recycled/ reused parts and their lifecycle validity while they are plugged back into the product's lifecycle
	Tiered supplier structure across products to identify green compliance and environment impact is a challenge

It is clear that most challenges are found in Facet I. If designers have better information during this phase, it can translate into better product response to the environment and reduced expense during the EOL stage. PLM provides better connect and visibility as it runs throughout the product lifecycle, enabling designers to take informed decisions.

Infosys' Solution Framework

Infosys is confident that the GreenPLM framework as shown in Figure 4, can support green product design and at the same time have a decreased impact on the environment.

Figure 4: Infosys' GreenPLM Framework



The Infosys GreenPLM framework is built using three components:

1. Green Governing Factors: Environment, energy, material
2. PLM Stages: Concept, design/produce, logistics, and end-of-life
3. PLM stage transitions

Green governing factors

The green governing factors i.e., environment, material and energy, control the complete green product development lifecycle.

Environment covers the impact of water, air, gas, electricity, and steam (Wages). Organizations must consider Wages in a product's lifecycle

Material covers the regulation-governed aspects of environment-friendly, non-hazardous materials for product manufacture. The type of material used while designing and producing products can help save the cost of product development and disposal at the EOL

Energy covers production and logistics techniques which consume energy in the form of electricity, gas and steam. Alternative and low energy-consuming processes and techniques can reduce the overall carbon footprint.

It is imperative that the governing factors complement each other rather than remain independent of each other. On the whole, green product development must cater to the governing factors mentioned above.

PLM Stages and Stage Transitions

PLM supports product development lifecycles in a phased manner. Ideations and conceptualisation lead to product design and manufacture. This eventually enables optimised logistics for the product to reach various customers. The product is then brought into end-of-life after being ripped and cleansed of all harmful components.

The GreenPLM framework enables each phase transition using the various components of governing factors. For example, remanufacture, direct reuse, and cleansed materials are direct inputs into the concept phase from end-of-life. While the component is declared ended, it can be decomposed / decommissioned as raw material either for the same product or for another product. Designers with access to such information must plug this in product development and then consider alternatives. Also, recycled components and reprocessed materials can help bring down the cost and time to market. The GreenPLM framework not only allows designers to use green materials, but also helps control the overall product cost.

Let’s look at the framework from a business perspective. With take-back legislations in place, producers must bring the product back to their own stables and then follow the dissection process to minimise environmental impact.

GreenPLM can help producers identify:

- Products that can be directly reused
- Components which can be remanufactured and plugged back into the product lifecycle
- Components which can be de-materialised.
- Designers coming up with green design alternatives using PLM are empowered to consider the optimal solution based on cost savings. Also, plugging back components reduces the overall product cost, which helps the Original Equipment Manufacturer (OEM) sell the product at a competitive price.

Conclusion

The Infosys GreenPLM framework takes into account all components that impact green product development and the various product development stages. Thus, it offers a solution to the numerous challenges faced by organizations while designing and developing green products. Since the framework also considers plugging in usable components of end-of-life products into new product development, the impact on the environment as well as the cost of production is minimized. Moreover, time to market is reduced. In the end, the customer stands to gain – he gets better quality products, faster, and at competitive prices.

Part 2

Part 2 of the series will detail the implementation methodologies of the GreenPLM framework and how they help designers meet green-compliance norms for product development.

Further Reading

- 'The Value of PLM and How To Get It', Kevin O'Marah, Michael Burkett, AMR Research, 2003
- 'Integrated Product Management', Sourabh Deshmukh, Jagmeet Singh, Infosys Technologies Limited, 2005
- 'Incorporating Environmental Issues in Product Design and Realization', Dr. Bret Brass, (UNEP/IE), Vol. 20, No. 1-2(double issue), 1997 Invited contribution
- 'The green challenge – Complying with the impending environmental regulations in the hi-tech industry', Vijay N Krishna, Sandeep Kumar, Ravikant Karra, Infosys Technologies Limited, 2004
- 'Getting From Green to Gold – Retail Success Factors and Outcome', Aberdeen Group, June 2008

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