

# Green Design Product Lifecycle Management for New Product Development

M.Muni Prabaharan<sup>1</sup>

**Abstract** - The success of an organization during New Product Development activities in the long run depends on the ability to base its strategies and processes on the products it makes. This scientific paper presents green design product lifecycle management for incorporating green engineering concepts into new product design. The proposed Product Lifecycle Management tool begins at DEFINE / PLANNING phase and ends at MANAGEMENT REVIEW phase. Developing a process in green engineering is very important. Poor process would result in ineffectiveness for contributing green design into the society. The result of this paper is any organization can implement this proposed green design PLM without affecting their regular process.

**Index Terms** - Engineering design, Green Design PLM, New Product Development

## I. INTRODUCTION

NOWADAYS, product designers and manufacturers are facing environment issues. Public awareness of the value and fragility of an intact ecology constantly increases. The cost of ecological burdens is shared by the society as a whole is no longer acceptable. The shortage of landfill and waste burning facilities constantly reminds us that our products do not simply disappear after disposal. This can be avoided by recycling concept. The aim of recycling is to maximize the recycled resources while minimizing the effort that has to be invested [1].

If we see the environment and potentials hazard, global warming might be the most pressing issue currently, but there are many more aspects, e.g., the depletion of raw materials and amount of water consumption. Water pollution through toxic constituents and eutrophication makes the problem. Exhaust emissions causing photochemical smog, acid rain and transmission of toxic substances is also issues in some regions. Further aspects include noise, odor, and radiation. All these impacts occur during a product's life cycle, maybe even several times.

*A company might only be involved in a specific single step within the general product's life cycle of raw*

*materials acquisition, component production, product assembly, distribution and retail, product use, (optional) refurbishment and reuse, and final disposal (or materials recycling) at the end-of-life (EOF).*

However, the relationship between upstream suppliers and downstream customers, consumers and potential recyclers means that individual companies have an (indirect) influence on and a responsibility for the environmental impacts throughout the entire life cycle [2].

*The objective of this scientific paper is introducing green engineering aspects into DEFINE / PLANNING phase onwards by using Green Design Product Lifecycle Management (GDPLM). It is a tool, in which planning, conception, detail design, research / prototype, production and introduction on the market in order to observe all relevant environmental aspects. At the end of each phase, stakeholders need to approve the project. And details will enter into GDPLM. It will make sure that, green design aspects covered in each phase.*

## II. BACKGROUND OF GREEN PRODUCT DESIGN

A number of research works are already available at different organizations / institutions in various countries with regard to the development of Green Engineering. This research work offer different approach with framework which includes all the phases of New Product Development.

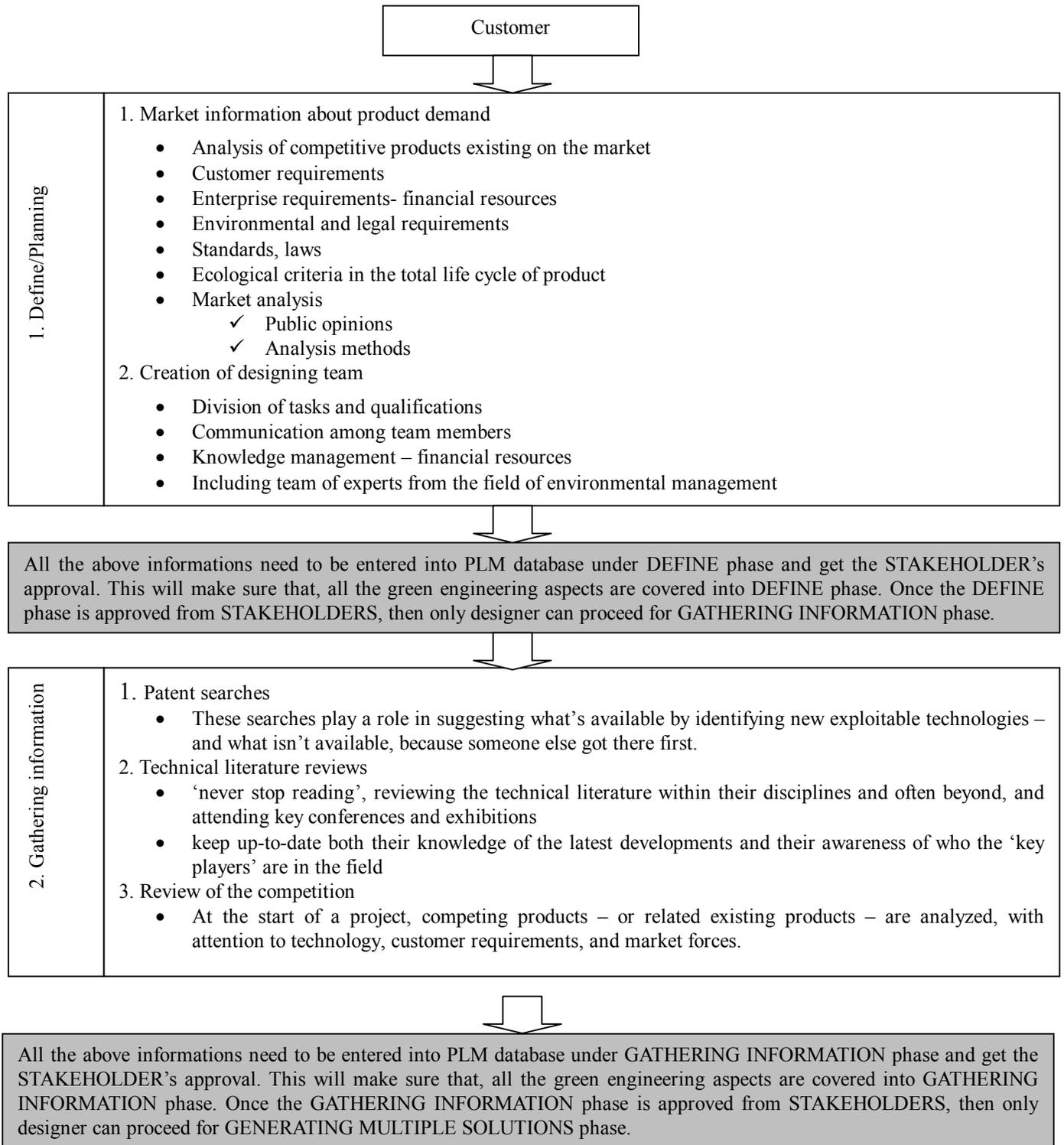
Green design is intended to develop more environmentally products and processes. The application of green design involves a particular framework for considering environmental issues, the application of relevant analysis and synthesis methods and a challenge to traditional procedures for design and manufacturing [3]. Product design is a process of synthesis in which product attributes such as cost, performance, manufacturability, safety, and consumer appeal are considered together. In general, products today are designed without regard for their overall impact on the environment.

<sup>1</sup> Independent Researcher, Hyderabad, Andhra Pradesh  
(Email ID: [mp.me89@gmail.com](mailto:mp.me89@gmail.com), Mobile No: 8790172431)

The role of product design changes throughout the life-cycle of a product. In the initial product development stage, the role of design is to create a marketable product from an innovation. The product may create a need where none existed before or quite different products may be competing with others in the same market. As the product

life cycle matures, more competitors enter the market and the chief role of design is in product differentiation; through quality, appearance, performance, ease of use, reliability, reparability and so on [4].

III. CONCEPTUAL FRAMEWORK OF GREEN DESIGN PRODUCT LIFECYCLE MANAGEMENT TOOL





3. Generate multiple solutions	<ol style="list-style-type: none"> <li>1. Openness to new experiences             <ul style="list-style-type: none"> <li>• Healthy and positive attitude toward new experiences</li> </ul> </li> <li>2. Willingness to take risks             <ul style="list-style-type: none"> <li>• Not afraid to take risks and try new experiences or ideas</li> </ul> </li> <li>3. Ability to observe details and see the "whole picture"             <ul style="list-style-type: none"> <li>• Notice and observe details relating to the problem</li> <li>• But step back and see the bigger picture</li> </ul> </li> <li>4. No fear of problems             <ul style="list-style-type: none"> <li>• Not afraid to tackle complex problems, and even search for problems to solve</li> <li>• Seek solutions to problems with their own abilities and experience if possible.</li> </ul> </li> <li>5. Ability to concentrate and focus on the problem until it's solved             <ul style="list-style-type: none"> <li>• Set goals and stick to them until reached</li> <li>• Focus on a problem and do not give up until the problem is solved.</li> </ul> </li> </ol>
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All the above informations need to be entered into PLM database under GENERATE MULTIPLE SOLUTIONS phase and get the STAKEHOLDER's approval. This will make sure that, all the green engineering aspects are covered into GENERATE MULTIPLE SOLUTIONS phase. Once the GENERATE MULTIPLE SOLUTIONS phase is approved from STAKEHOLDERS, then only designer can proceed for ANALYZE phase.



4. Analyze	<ol style="list-style-type: none"> <li>1. Concept design             <ul style="list-style-type: none"> <li>• Brief foredesign</li> <li>• Analysis of available solutions</li> <li>• Analysis of available methods and tools</li> <li>• Analysis of results</li> <li>• Choice of improvement strategy</li> <li>• Analytic tools of LCA</li> <li>• Minimization of using materials and resources quantity</li> <li>• Energy saving</li> </ul> </li> <li>2. General design             <ul style="list-style-type: none"> <li>• Specification of available materials and technological process</li> <li>• Economic analysis</li> <li>• Proper quality assurance of the product</li> </ul> </li> <li>3. Detailed design             <ul style="list-style-type: none"> <li>• Design in detail</li> <li>• Restricting of possibilities (materials, technological process)</li> <li>• Optimization</li> <li>• Elimination of harmful and dangerous materials</li> <li>• Minimization of resources and material usage</li> <li>• Renewable resources usage</li> <li>• Waste reduction</li> <li>• Usage of materials from recycling</li> <li>• Usage of materials about low influence on the environment</li> </ul> </li> </ol>
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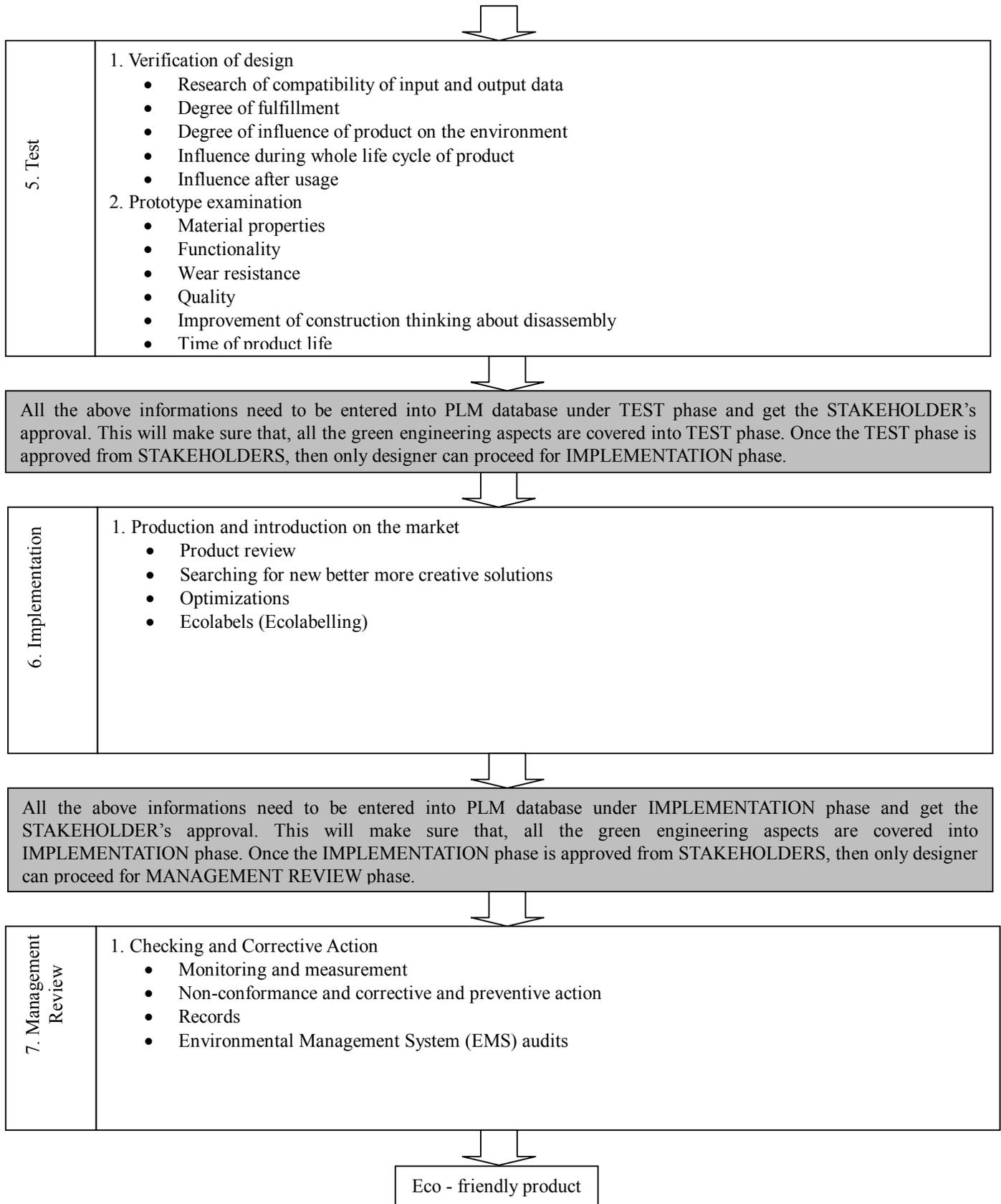


Fig. 1 Conceptual Framework of Green Design Product Lifecycle Management Tool

#### IV. EXPECTED OUTCOMES OF THE PROPOSED GDPLM

The proposed GDPLM reduces the amount of waste through remanufacturing, reuse, and recycling. It also reduces the environmental impact of its products by placing environmental considerations at the forefront of all products and manufacturing decisions. It minimizes the impact of raw materials used in its products and reduces energy requirements.

#### V. BUSINESS OPPORTUNITIES FOR SUSTAINABLE DESIGN

Beyond managing risk or pressures from external parties, sustainable design offers a variety of opportunities to prosper. Companies can gain access to markets, increase market share, reduce or avoid compliance costs, and more easily attract investor capital. There are also positive ripple effects related to product performance, cleaner production, customer satisfaction and brand loyalty, employee morale, and community relations. These opportunities provide the business case for sustainable product design the way to strengthen a company's position and produce benefits for the bottom line [5].

#### VI. CONCLUSIONS

Nowadays, industry is expected to make greater contributions to solving the ecological problems created by their products, due to the continuing disturbance to our environment. In this scientific paper, the author proposed a Green Design Product Lifecycle Management tool which allows industry to take responsibility for the whole life cycle of a product starting at the DEFINE phase itself. The decision making about designing of the environment friendly product is not a problem, it is important to realize the design in due time, with predetermined budget, and this requires the perfect organization of designing process. In this moment very useful approach can be carried out. It systematizes workings performed during designing process and shows the meaning of the ecological aspect in this process.

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#### AUTHOR'S BIOGRAPHY



**Muni Prabaharan** is a Design Engineer with Integrated Engineering Solution Unit at Mahindra Satyam, Hyderabad, India. He has received his Bachelor of Engineering (Mechanical) with Gold Medal from Anna University in 2010. Till now, he has written 70 scientific papers at International and National level as Lead author. He also written a scientific book and published by a German Academic Publisher. His research interests include Structural Analysis, Computer Aided Engineering and Green Product Design. He is certified Professional of Six Sigma Green Belt, Associate Value Specialist, Engineering Design and Design Process. Currently, he is incorporating Lean Six Sigma in Design application in his current role. The President of World Forum Federation invited him as Ambassador for India. He has honored as Outstanding Intellectual of the 21st Century, Top 100 Educators 2011, Man of the Year, International Peace Prize and Award of Excellence. He also received Rajya Puraskar award from Ex-Governor of Tamilnadu, India. His other roles are Associate Editor / Scientific Committee / Associate Editor / Technical Committee / Reviewer / Editorial Board Member of leading International Journals, Conferences and their Associations.

Muni Prabaharan can be reached at 91 8790172431 or his E-mail: [mp.me89@gmail.com](mailto:mp.me89@gmail.com)