ISSN: 2277-3754
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 1, Issue 3, March 2012

Comprehensive & Collaborative Approach towards Eco-Sustainability through Implementation of Green Product Lifecycle Management

Prakash Chandra Agrawal, Vikas Yadav

Abstract— Environmental consciousness and awareness has been certainly the need of recent times, Researchers, Governments, Environmentalists, Commercial firms and Industries are all now promoting and advocating eco-friendly approaches for a sustainable future. To make environmentally aware, products ranging from consumer goods to machinery, waste material, civil materials, warfare, transportation etc., remain to be one of the major contributing factors to the overwhelming environmental concerns and services. Eco-sustainability (Also Environmentally Sustainable, Eco-friendly, Nature Friendly, and Green) are synonyms used to refer the goods and services considered to inflict minimal on the environment. The sustainability is a powerful and defining idea to develop & implement Environmental, Social and Economic Sustainability strategies into businesses, it is one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts." People, planet and profit" succinctly describes the triple bottom lines and the goal of sustainability. The term "Triple Bottom Line" is widely credited to John Elkington, head of the consulting firm Sustainability, who first coined the phrase in 1994. Elkington was referring to three dimensions of accounting – economic, environmental, and social. For Achieving environmental sustainability, it is required to manage and protect the ecosystems to maintain the economically productive and ecological functions, maintaining the diversity of life in both human-managed and natural systems, and protecting the environment from pollution to maintain the quality of land, air and water.

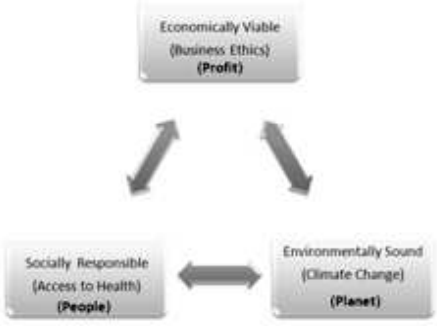

Fig. 1 Block Diagram

***Keywords*- Eco-Sustainability, Product life-cycle management, Environmental Compliance.**

I. INTRODUCTION

The Eco-sustainability approach to PLM process is developing methodologies to support sustainable production during the whole product lifecycle. The present research makes a focus on the first phase product development that is significant to set future costs and environmental impacts. Product lifecycle management (PLM) is a systematic approach to managing the life cycle of a product, from its design and development to its ultimate disposal. PLM is typically broken into the following stages:

Beginning of life (BOL), which includes new product development and design processes. Middle of life (MOL), which includes collaboration with suppliers, product data management and warranty management.

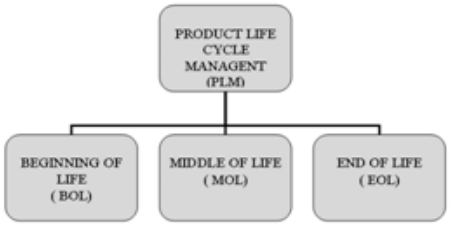

Fig. 2. End of life (EOL)

Product lifecycle management systems provide a platform for the management of data related to the creation and disposal of products. These systems assist the participants in the products' life cycle processes (manufacturers, suppliers, customers, and regulators).It's key role as a key component in reducing the use of material and energy.

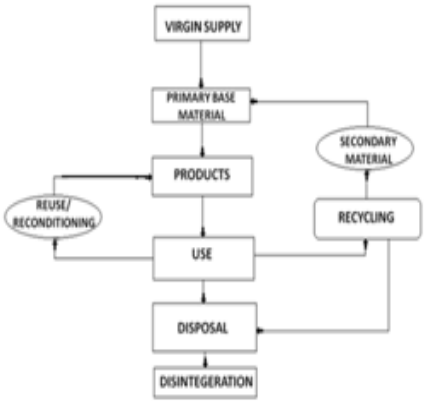

Fig.3. Flow Diagram

Green Manufacturing [2] encompasses Manufacturing with reduced waste and pollution through innovative product and Process design, including the use of new materials and supply chain. , Cradle to Cradle" process - reuse/recycle Minimum damage to environment and human, low energy consumption. The greater challenge before the industry is how to be environmental friendly. The answer lies in adopting a total mindset oriented towards Green Product

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Lifecycle Management - An Comprehensive & Collaborative Approach towards Eco-Sustainability .It means at the designing stage itself, eco-friendliness needs to be kept in mind. Those manufacturing processes should be chosen which consume less energy. It also dictates that at every component and process of the supply chain- a green alternative is looked for and weighed for all its pros and cons.

We understand that this sense of well-being also requires that our products are made in a caring and responsible way that preserves the environment for future generations. We apply a product life cycle management approach involving our partners from farm to consumer in order to minimize the environmental impact of our products and activities. Our aim at all stages of the cycle is to use natural resources efficiently, to favor the use of sustainably managed renewable resources and to target zero waste. Eco-design plays a central role in balancing technical, economic, environmental, even social concerns in new product introduction to achieve optimized sustainability performance throughout the product lifecycle. Applying eco-design and sustainability principles to the new product introduction process, an integrated sustainable design approach to improvement of product performance in lifecycle cost control, environmental impact reduction, and regulation compliance management.

Werner [4] defines green design, or design for the environment, as practices which yield products with minimal environmental impact. The environment is not only impacted by the use of resources to manufacture the product but also by its use by the consumer and finally its disassembly and disposal. Green engineering is an approach which aims to control and reduce pollution by taking into account the impact of the products on the environment during the design phase. Product lifecycle management systems provide a platform for the management of data related to the creation and disposal of products. These systems assist the participants in the products' life cycle processes (manufacturers, suppliers, customers, and regulators) to use data efficiently for planning and control. However, most data collected do not resolve the environmental issues which arise when selling the products or arranging for the products to be replaced and/or disposed.

II. LITERATURE REVIEW

Product lifecycle management, sometimes "Product life cycle management", represents an all-encompassing vision for managing all data relating to the design, production, support and ultimate disposal of manufactured goods. Product lifecycle management or PLM is an all-encompassing approach for innovation, new product development and product information management from ideation to end of life. PLM's role in sustainability has become crucial for many businesses. Eco-sustainability in the context of product lifecycle management has two main aspects of sustainable product lifecycle management which are product information and environmental information. Product Information is obviously data about all product characteristics, design materials, supplied components, etc. This information is actually what to design with sustainability in mind.

The second one is all environmental information related to materials and products. This is the information that needs to be in hands of designer or any other person and/or organization that thinks how to design with sustainability in their minds.

III. RESEARCH PROBLEM

To formulate the comprehensive & collaborative approach for design, development and smooth implementation of Strategic initiatives, Planning & Processes for execution of Pragmatic solutions towards Eco-sustainability through adopting green PLM supports manufacturing practices.

IV. RESEARCH OBJECTIVE

To Design & Develop the Eco-sustainability and eco-conscious products life-cycle management that would reduces the environmental load throughout the product life cycle as well as to eliminate waste and improve efficiency.

V. THEORETICAL FRAME WORK

Manufacturing with reduced waste and pollution through innovative product and process design, including the use of new materials.

"Cradle to Cradle" [3] is a term used in life-cycle analysis to describe a material or product that is recycled into a new product at the end of its life, so that ultimately there is no waste. Zero waste. The below diagram illustrates a sample framework for understanding the main drivers of environmental impact in the cradle-to-cradle1 product lifecycle. Cradle-to-cradle is a framework for manufacturing systems that are essentially waste-free. It covers the entire product lifecycle including take-back and recycling of waste for the manufacture new products.

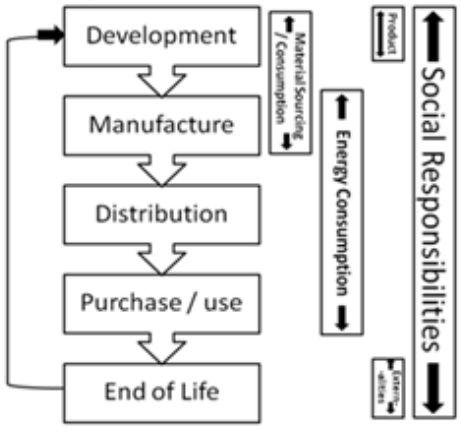

Fig. 4. Framework

VI. CRADLE-TO-CRADLE PRODUCT LIFECYCLE

Material Sourcing/Consumption refers to the raw materials that are supplied and used during development and manufacturing. Cradle-to-cradle requires that materials be managed in an integrated way to maximize both environmental and business benefit. For example, designing

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products with efficient packaging can simultaneously reduce costs and improve sustainability.

Energy Consumption refers to the type of energy used (i.e. traditional carbon intensive sources versus clean renewable sources) for production and distribution of a product, as well as the emissions produced during the consumer use phase of the product.

Product Externalities refers to the impact of the product on consumers and communities that are not part of the traditional lifecycle. This may include, for example, whether the product can be returned to the manufacturer for re-use, or the elimination of harmful by-products.

Social Responsibility considers treatment of workers, labor conditions, fair wages, community investment, and interactions with foreign countries and governments. Minimum damage to environment and human, low energy consumption

VII. The Role of different Management Levels in Life Cycle Management

A. Normative Level

- Establishment of general and basic goals of management, principles, norms, rules for securing viability and capability of development of the company
- Integration of a sustainable development into the general value system of an Enterprise
- Implementation of sustainability-oriented objectives into the vision and mission statement of a company

B. Strategic Level

- Development of strategic guidelines to make full use of success potentials along the product life cycle
- Depiction of chances, risks, measures and goals
- Development, maintenance and effective use of market-oriented success potentials

C. Operative Level

- Realization of the normative and strategic guidelines in the operative performance of the established plan
- Integration of sustainable acting as cross-sectional function into all areas of responsibility of the company
- Inclusion of all operative management tasks (plan, do, check, act)

VIII. Conclusion

From the following Figures No. 5 & 6, it is finally concluded that the comprehensive & collaborative approach towards eco-sustainability through implementation of green product lifecycle management are maximizing ecological & social benefits as well as minimizing the ecological & social harm as shown below:

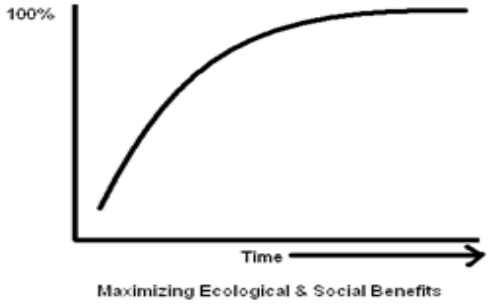

Fig. 5. Graph of Maximizing Ecological & Social Benefits

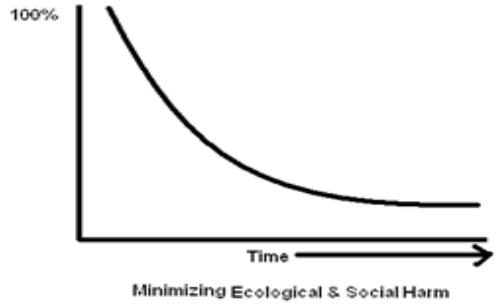

Fig. 6. Graph of Minimizing Ecological & Social Harm

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