

A Review on Green manufacturing: Environment Salvation in India

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Abstract: Green manufacturing (GM) is fast emerging as the sustainable manufacturing solution that has the caliber to resolve most problems that the world faces in today's scenario. Emission of harmful gases like: CO₂ and waste is one of the most alarming factors for environment degradation which leads to acid rain and global warming. With the help of green manufacturing we can minimize, pollution, waste as well as conserve resources which is based on environment management system, energy conservation, development of cleaner products, sustainable infrastructure. .

Green accounting takes into consideration not only value of natural resources but also the costs of pollution and depletion of natural resources. Industries exposed new aspects such as green supply management and value chain transition as used in cardboard industry which is used in cardboard industry which tells that recycle the product if it is useless.

Keywords: *Green manufacturing, Sustainable manufacturing, Innovation.*

I. Introduction

Manufacturing sector is vital for the emerging and developing economies to improve the quality of life of their citizen. The limited natural resources and growing energy demand is slowing down the pace of development in developed countries, meanwhile, the manufacturing sector of emerging countries is attracting global attention because of untapped potential for growth in terms of natural resources and human resources, in addition to relatively less stringent environmental legislation [1]

At the same time, the growth of manufacturing sector brings in some challenges like fast depleting natural resources; soil, water and air pollution; and severe health hazards to humanity. These challenges are posing risk to sustainable development of the planet.

The need of achieving higher economic prosperity with least environmental impact has led to a new manufacturing paradigm of Green Manufacturing (GM). GM means Green manufacturing is a system that integrates product and process design issues with a issues of manufacturing , planning and control in such a manner to identify , quantify , assess and manage the flow of environmental waste with the goal of reducing and ultimately reducing environmental impact while also trying to maximize the resource efficiency.

II. Literature Survey

A brief review of same has been presented in this section.

Varinder Kumar Mittal, Kuldip Singh Sangwan[2]

Industries utilized energy and natural resource in unfeasible manner and emit large amount of green house gases which

leads to social as well as environment issues. Most of the industries implemented green manufacturing because they are concern towards the pollution, global warming, as well as natural resources depletion and these blockade are reduced by concerning as high priority fence and further try to overcome by available resource.

Ahmed M. Deif[3]

External and internal factors are the part of manufacturing system with the awareness towards environmental risk as well as it develops a new green manufacturing criterion. It helps to implement your idea to eco efficient manufacturing. By various planning stages conducted by required control scale and different green tools in an open mixed architecture and this system is demonstrated by industrial case study.

Mohnty and Deshmukh[4] highlighting the importance of green productivity as a competitive edge. They defined green productivity as all activities attempting to decrease wastes. They showed various case studies with different waste elimination practices to highlight the potential green productivity can have on the overall manufacturing performance.

Naderi [5] showed that green manufacturing is highly tied to waste management through the elimination of causal factors.

Swapnil v. Ghinmine & Dilip I. Sanotra[6]

The aim of this paper is to identify the factors that helps to implement the green manufacturing in the industry. The

CO₂ emission and the waste that is generated from the industry is one of the main factor for the environmental degradation which leads to global warming and acid rain. Government rules and regulation are the key important factors that helps achieve the environmental, economic and intangible performance. Data regarding the survey was collected and analyzed by the mean score. Implementation of these factors in the industry helps achieve economic growth at national and international level.

Prakash Kumar Sen[7] The present paper gives the survey of green manufacturing, through this paper an attempt has been made to visualize the recent developments and innovations and researches to implement the green manufacturing techniques, this study is helpful to aware about what is green manufacturing why it is needed and keys of green Manufacturing that reduces the undesired waste and even pollution. The paper mainly focuses on the green manufacturing design of components without harming the nature. The main objective of this paper is to bringing the attention of the manufacturer who is manufacturing the product with the mass production toward green manufacturing. It has been observed that lot of waste are being produced during manufacturing in different industries which can be minimized by implementing the green manufacturing techniques. The results of this study indicate that the green manufacturing applications have a significant positive impact on environmental performance and social performance.

Kemp and Arundel [8] The innovation in green manufacturing as all the measures taken by relevant stakeholders to promote the development and application of improved or new, process, products, techniques and management systems that contribute to negative environmental impacts and attain specific ecological goals. According to Chen *et al.* (2006) green innovation can be classified into three main categories as green product innovation, green process innovation, and green managerial innovation. This classic division allows creating a focus for the ecoinnovation concept and suggesting possible areas of application. This study focuses on green product innovation and analyzes the relationships between green product innovation, firm performance, and competitive capability using managerial environmental concern through moderator variable as can be seen in Figure 1.

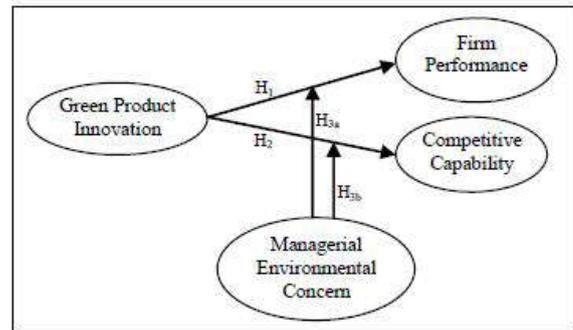


Figure 1: Affecting Parameters of Green Product Innovation

III. Key of Green manufacturing

Green manufacturing & its role in technology has four specifications as shown in diagram.

1. Environmental Management Tool
2. Sustainable Manufacturing
3. Sustainable Green Operation
4. Green Supply Chain Management

1. Environmental Management Tool

It consist of mass balance according to which consider input and output of a process and check it proficiency and wastage. Cost accounting include materials, energy, labour, waste, disposal & varied item cast.

Product life cycle has three stages.

- Conceptual, preliminary & detailed design
- Production construction
- Operational use

In this study, the feasible cost of function are derived with systematical engineering process. Implementing prolonged manufacturer execution to achieve a critical authority between environment and business profits. Producers should have the quality to product recovery and remanufacturing by designing same or different product for easier disassemble and reuse.

With the product life cycle value design pertinent material selected and decision are taken (such as selection of easily recycled product, component and dangerous material) in order to reduce gloomy impact on environment toffel (2002).

Y(MT) is a function of MT which shows the supplier's component life cycle designing cost where T is product life cycle. It plays major role to increasing the product design life. They both are dependent to each other.

Sustainable Manufacturing

This concept is come into the light through a series of reports and meeting in 1970's and 1980's and the main reason behind was disaster, incident of environment, chemical contamination and resource depletion.

Sustainability is more impact than simple analyzing and modification of manufacturing process and system. Now a days, sustainable manufacturing used carelessly instead of characterizing and reducing environment impact of manufacturing

Sustainable Green Operation

It is an originative environment approach, serves to ensure the quality acknowledgement for electronics manufacturing input such as electronics metal and component as well as output such as finished products, waste. Zhu et al (2007) is concerned about balancing and pollution reduction as well as improve financial performance. Environment practice of green manufacturing is focused upon product steward ship and concerned with reducing environmental business with minimum use of non-reducing and hazardous material in product development and it is considered environment impact on product design, in of material Snir (2001) and packaging. Its main aim is to promote recycling and reuse of product which is used earlier.

According to product steward ship of electronics manufacturers considers the impact of product or environment and packed from raw material achieved to end product disposal as per Dechant and Altman (1994).

Green Supply management

It is the accession of green issues into the supply chain management Herrani et al (2005). It indicate that GSCM activity such as manufacturing, reuse and recycling which are enclosed in green practices, green designing, environmental friendly packaging, transportation and discrete products extinction.

Globally, automobile industry expands into asia region Kumar & Bali Subramanya (2010). Greening in automobile sector disprove in environmental policy as well as international energy.

The aptitude and appraised of performance is demanded when demanded when environmental issue is main concern olugu et at. (2010). By implementing green concepts into automobile manufacturing is essential to reduce compliance Gan (2003). Zhu et at. (2008). Assertion that automobile firms are budding and encouraging industry because it creates giant market. Zhu et at. (2007) attert that Chinese automobile industry is most concerned about the environmental burdens, the government of china has tightened the environmental regulation Zhu et at. (2007) so automobile enterprises started study with his international partner Zhang & Peng (2000). Other example is that Malaysian government inscribe issues regarding environment, especially exit vehicles recovery Amelia et at. (2009) since Malaysian automobile industry rapidly develops, GSCM forces government & automobile industry to worry about burdens Eltayed et al. (2011). So GSCM

plays an important role to reduce environmental hazard and economy profit to manufacturers Diabat and Govindan (2010).

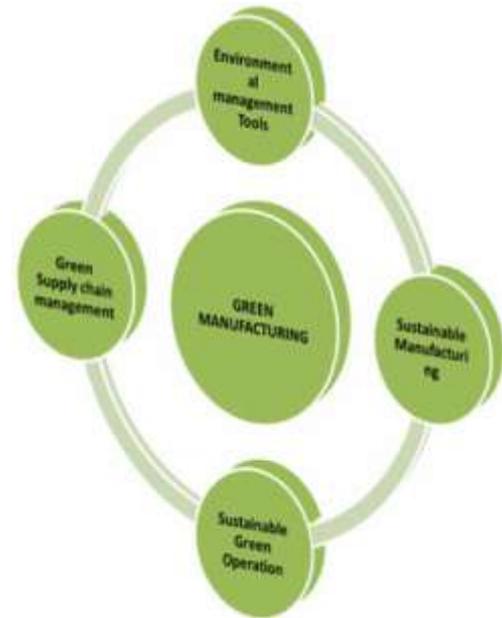


Figure 2: Keys of Green Manufacturing

IV. Green Manufacturing Agenda for India

5.1 India's Green Challenge:-Sudden financial and industrial growth coupled with organization which increase demand of barren resources like water and increasing waste generation, India has on 4th in largest economic and 5th on largest GHG emitter in the world.[9] There is sudden increase in CO₂ emission from 1990 & 2008 i.e more than 150% rapid industrialization & urbanization generate monster waste.

E-waste is becoming a major area of concern for India. It suggest that only 3% is making recycling facilities, with landfills or recycled in recycling yards and it is become doubled from 450 KT to 800 KT/annaum.[10]

5.2 Setting the Agenda for Green Manufacturing: For manufacturing forms should consider about 3 areas such as green energy, green product as well as green process.

1) Green energy: Industry and government has to be focused on environment and urbanization. India has maintained many laws regarding environmental protection. According to UN environment program (UNEP)-Global Trends in sustainable investment 2010, India was at seventh position in sustainable energy. Under National Solar Mission, the government plans to generate 20000 MW of solar power by 2022 in 3 phases with 2000 MW capacity. India is at fifth position in wind energy producer plant with capacity of 11500 MW and has 3 times than current and wind potential is at top.[11]

Bureau of energy efficiency establish the support awareness demand creation for good, services and product. It also setup functional platform. In union budget 2010-11, government announced national clean energy fund for finance research and projects.

2) Green products:

Indian companies also considers distraction of has hazardous substance (ROHS) for many of their product such as furniture with creates a variety of product that provide greener customer experience in term of emitting lower volatile organ in compound (VOCS). Why sum of firms introduce green products in to market to cover the manufacturing sector.[13]

3) Green processes in business operations

Indian manufacturing is catching up with the long term benefits of Green processes to improve corporate brands, reduce costs and achieve compliance at the same time. Energy intensive companies are implementing lean processes to minimise waste and enhance energy efficiency. For example, the shortage of reasonably priced domestic high-grade coal is forcing cement companies to be more innovative in their manufacturing operations. Power consumption in an engineering plant can be reduced by using more power-efficient motors and moving to Compact Fluorescent Lamp (CFL) and natural lighting in the buildings. By adopting these measures, an engineering plant was able to reduce power consumption by nearly 35 percent in a short span of time.

V. Conclusion

The theme of this paper is try to convey the attention of the industry to use green manufacturing and relationship between economy and environment. Sustainable manufacturing is the best option for industry as well as daily uses for manufacturing. Green supply management plays an important role for boost the industry performance as well as growth. Conclusion of this paper is to protect environment and earth through opportune methodology should be imitate by industry.

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