# Smart and Green Manufacturing Eco System

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***Abstract:***

*Green manufacturing has a crucial role in protecting our ecosystem. We are forced to face and find the solution for the most contradicting issue of today's time that is how to meet the customer requirements without causing damage to the environment. It is high time to react and be a player who is able to create a win to win situation for environment as well as the industrial growth. The main vantage point is how to protect our environment without impeding the growth of manufacturing sector. Green manufacturing should not be taken as a measure but it should be adopted as a process. Green manufacturing should be adopted in manufacturing facilities, throughout the supply chain and customer base. The $4^{TH}$ generation industrial revolution is having a significant impact on reducing the waste to landfills. This is only possible when the life cycle of the good is extended and also by developing eco-friendly materials. New methods are being adopted by the industries to mitigate the carbon footprints. The two main agendas of green manufacturing are 1) production of green products 2) Reduce the pollution by reducing the emission and also by reuse, recycle and reduce the use of natural resources.*

***Key words*** *- Green Manufacturing, Digitization, sustainability.*

## Introduction:

Green manufacturing is an environmentally friendly operation that the manufacturing is adopting these days. These methods are used to reduce their impact on the environment and to achieve environment sustainability. Green manufacturing is also known with names such as clean manufacturing, environmentally responsible manufacturing. Apart from producing green products importance to reduce, reuse and systematic usage of natural resources is also done.

## Importance of Green Manufacturing

Every manufacturing industry produces by-products. These by-products are hazardous to the environment and for the future beings to survive environmentally friendly operations should be adopted.

## Evolution of Green Manufacturing

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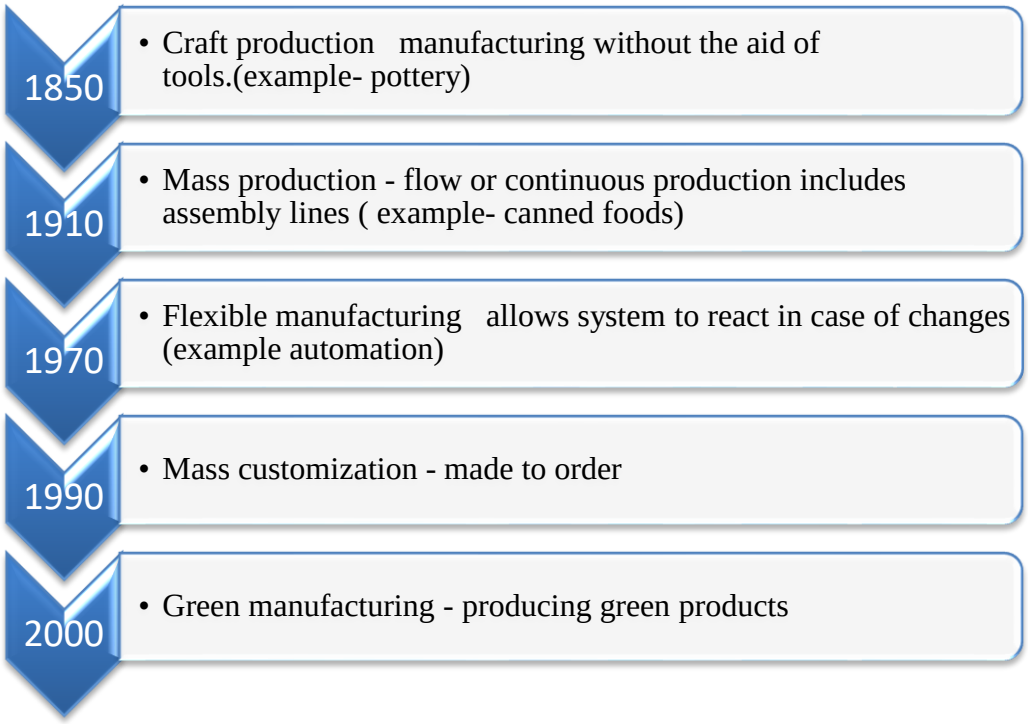



**Definition of Green Manufacturing-**

**Belinsky 1995** – Stated that any company trying to compete globally should produce and adopt green manufacturing techniques to establish and comply with in the green regulations of European market

**Mendler 2005** - Green manufacturing is meeting the needs of present generation without compromising the ability of the future generations to meet their own needs.

**Cortellins 2001**- Green manufacturing is a method of manufacturing that minimises waste and pollution slow the depletion of natural resources as well as lowers the extensive amount of trash that enters landfills.

## Review of Literature

The objective of this research work is to navigate through the practices of green manufacturing. The review consists of definitions of green manufacturing by authors. Green technology adopted by Indian manufacturers. What are the three manufacturing giants of the world and their contribution towards green manufacturing? Green techniques that can be adopted by companies. How can we as an individual can contribute towards green manufacturing? Last but not the least the methods adopted by the top 3 green countries of the world and where India holds its position.

## Techniques of Green Manufacturing

**1) Change in the production process**- the manufacturing goes green when the organization uses minimal natural reprocess zero landfills, reduced carbon foot prints and produce products which can be reused and recycled.

**2) Input changes in the process of production**- If a small change in the production process is able to create a bigger difference in the carbon emission then that can be further approached.
***Example***: **McCormick paints**- coloured paints developed by the chemists' acts as an adhesive to the vehicles body frames. This not only saves energy consumption but also the time when compared to liquid painting approach. These plastic paints are equal to 15 coats of traditional painting. Companies like soliant paint film are working with chrysler and G.M to adopt this technology in R automotive paint application. When this approach is adopted by major part of the automobile industry which can lead to noticeable change in the reduction of emission and energy conservation. The use of powder based and high solid paints reduce the emission as well.
**3) Re use of in-house material** – reuse of plastic totes. Reuse of wooden pallets that are used to store and ship products. Use of natural lights during the day by turning all the electrical lights off during the day.
**4) Best housekeeping** – proper segregation of waste reducing chemicals and other inventories. The green manufacturing necessitates converting the industrial operations in Development of green products. Process that needs to be adopted in manufacturing process for green products

**Idea for green products through proper research:-**
All over ideology is that, the life cycles of the goods are extended and new measures are being adopted by the industries to mitigate the carbon foot prints.

**Advancement and the approach adopted by cement industry in green manufacturing**
***Example:*** The use of timber and pozzolan based concrete in the place of Portland cement by reducing carbon foot prints.

**Green manufacturing in Packaging Material**
Apart from focusing only on the end products in the manufacturing significance should also be given to the packaging material. Since packaging material contributes to 40%of the plastic waste. India generates 25,940 tonnes of plastic waste per day as per the study of CPCB.
Green manufacturing is a process it is not just related to the end product. The companies while manufacturing should think are we using plastic free packaging, or can it be recyclable or reusable.
***Example-***
Nestle announced its agenda to make its packaging reusable by 2025.
MC Donald's has made a commitment that it will reduce foam packaging from its entire supply chain.

**Few organizations are creating alternatives to reduce plastic packaging.**
***Example*** - Australian based plastic technologies created a ultra-high barrier bio plastic material for packaging the plantic-R combined with the best bio based high barrier material with PET to create a recyclable material that is useful for both tray sealing and Thermoforming applications. Much priority to the shelf life of the product is also given. It is already being used by **Coles** own label lean beef mince. The energy consumption of this technology is also half when compared to the traditional fossil fuel plastics.
***Example*** - Earth pouch – another innovation in packaging Peter Ralten from (B&G) partners with siranes food packaging manufacturers for this product. The earth pouch can be easily recyclable and easily compostable.it is 100% plastic free and is used as a stand up pouch used to store dry and moist food.

**Digitization**

"Energy conservation is the heart of green manufacturing"

***Example*** **-** china national building materials group has efficiently cut the usage of energy by 10% with digitalization. China has a global online retail sale of 55.8% ,by 2022 it is expected to cross 63%.Digitalization has the ability to reconstruct four Industries they are Retail, Automotive, health care, freight and logistics. Digitalization is the use of digital technology to change a business model. It is more about business operations in short automation is the heart of digitization.

**Contribution of Indian companies towards green manufacturing-** (Business Wire India, 2019)

International research Institute for manufacturing recently honoured companies for their contribution in green manufacturing challenge.

**Bharat petroleum corporation ltd. (Mumbai refinery)** bagged the top award.

***Example:*** Measures taken by Bharat Petroleum Corporation.ltd

- It developed renewable energy. Solar capacity with 1 MW and another 0.5 MW generation will be done by 2019 December. With this measure the power saving is estimated to save 5.08 lakhs unit per annum. (1 unit =1 kwh).
- It is able to save on energy up to ₹ 45.72 lakhs per annum considering the electric tariff to be ₹ 9 per unit. Reducing 365 tons of carbon emission per annum.
- It also carried out tree plantation drive by planting 12000 trees in 2019.
- BPCL (Mumbai refinery) plant uses 13500 T/D of water for its plant operations and other uses. It is supplied by MCGM- Municipal Corporation of Greater Mumbai.
- It also has taken water recycling measures. They signed a Memorandum of understanding with Rastriya chemicals and fertilizers for setting sewage treatment plant at trombay to treat 22.75 million lutes which is capable to produce 15 MCD of treated water. The Mumbai refinery is receiving this treated water in raw water-cooling towers. Apart from all these measures BPCL has also adopted rain forest harvesting as we know the importance of water.
- It also developed butterfly garden. The plants in this garden are carefully selected to attract more butterflies and provide a supportive environment for butterflies to sustain. We know the butterflies' role in food chain.

**SME (Small Medium Enterprises) can also contribute to Green Manufacturing** - It is not necessary that only the large-scale industries need to focus on green manufacturing. SME's are also paying their attention towards green manufacturing, since they have also realised that their collective foot prints will also have a major contribution towards industrial pollution. SME's are slow but are heading towards better environmental measures. They have also started to taken measures to reduce water usage, power usage and Planting trees etc.

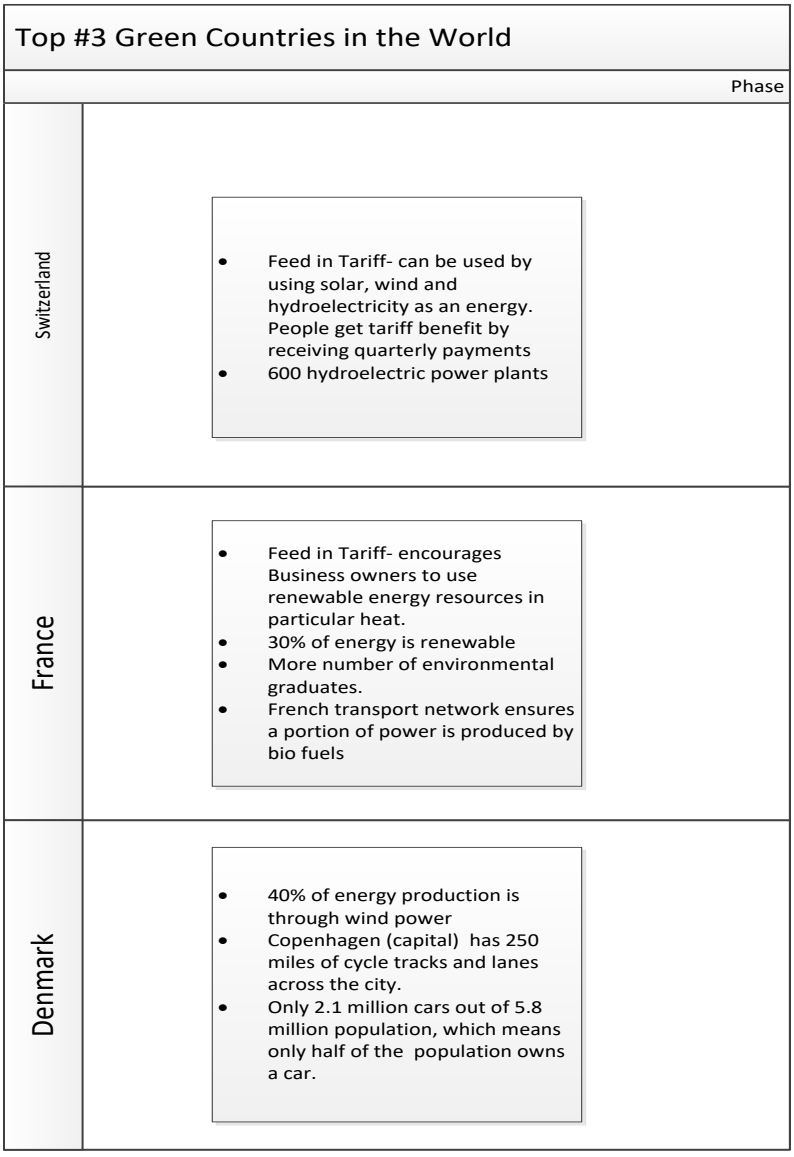
**Job creation opportunities in Green Manufacturing**:

According to UN reported the actions taken towards green manufacturing will help us get 65 million new low carbon jobs by 2030.It could result in $26 trillion in economic benefits worldwide. In India also lakhs of new jobs can be created if the countries manufacturing sector pays attention towards carbon footprints.

**Top 2 Green Manufacturing Companies (2019):**

**MC Donald's** – has set up green parking lots. These lots have the capability to recharge the vehicles and clean ground water.

**Dell-** customers can give back the dell products back to the company for safe disposal of the product reducing e- waste. It also encourages electronic appliances from other companies for safe disposal.




According to the study by Yale and Columbia University, **India holds 177$^{th}$ position out of 188 countries**

## Conclusion

Green Manufacturing is the new mantra that the world is following these days and this a source through which sustainable growth can be achieved. Plastic packaging collected for recycling is only 14% according to Ellen Mac Arthur Foundation – one dump trucks worth of plastic enters ocean every minute. We also need to avoid single use plastic since this is the only planet that humans can live right now, so it is equally everybody responsibility to reduce carbon footprint, E-waste, reduce the usage of plastic by every individual. Over consumerism should also be tackled which is also a valid cause for global warming. As companies are focusing on green products and longer lifecycle of products, consumers should also do their bit by avoiding over consumerism.

## Suggestions

- Much importance should be given to environmental studies in our country who can contribute for the future industries to become carbon free.
- Tata steel has launched steel doors in the manufacturing field as at least two trees are required to make a door. In India 80% of door are made of wood, so adapting to new materials like, PVC we can control the usage of wood.
- Companies should include Green Manufacturing as a policy and procedures.
- To the possible extend every individual should also do their bit to buy and consume green products, this can encourage the companies to do their bit to achieve sustainability.

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