

# Chapter 5

## Sensitization of Sustainable Manufacturing Strategies to Benefit Indian SMEs

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### ABSTRACT

*In recent times, globalization policy eliminates the restriction of market boundaries, enabling all manufacturers to exploit the markets of developing countries, due to which, the environmental regulations in the developing countries are evolving to secure their nature with stringent regulation. In this view, this article is written to impart knowledge on sustainable manufacturing to all manufacturers. However, for successful implementation of sustainable manufacturing practices, formulation of strategies is found to be essential. In this view, critical insights have been presented by reviewing existing practices of sustainable manufacturing, how to deploy them and their correlation with the environmental benefits are mapped to support practicing managers. The practices discussed in the chapter include process optimization in view of the environment energy modeling, waste minimization options, better end-of-life policies, material efficiency and need to employee training.*

### INTRODUCTION

In the past, lack of availability of natural resources forced the manufacturing organizations to improve labor efficiency through various manufacturing strategies by utilizing abundant natural resources. However, increase in population and over consumption of natural resources redefines manufacturing strategy. The evolution of manufacturing system starts with Craft Production System (1890 – 1910) in Automobile manufacturing and in the year 1910 Ford Motor company introduced Mass Production System which is based on economies of scale. After the Second World War, an advanced production system called Toyota Production System (TPS) (1950 onwards) in Toyota Motor Company, then in 1980,

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lean manufacturing evolved by integrating advanced tools from world-class manufacturing system and TPS which also includes Supply Chain Management. In 1987, Brundtland Commission emphasized the importance of sustainable concepts and defined sustainable development as “Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

The sustainability concepts have been further flourished by many researchers in the past decade (Vinodh, 2011). Sustainability can be viewed in three orientations namely product, process, and material. In India, manufacturing organization contributes to 18% of total energy consumption (Central Statistics Office, 2013). Manufacturing processes account for a major proportion of energy consumed by manufacturing organizations. India ranks 5th in Generation of Greenhouse Gases (GhG) and these non-specific processing industries contribute approximately 134 million tonnes of CO<sub>2</sub> equivalent. Thus, the interest has been shifted towards manufacturing processes in the recent times. For successful implementation of sustainable manufacturing practices, identification and implementation of strategies form critically. Thus, literature search strategy for this research was developed by first identifying the likely relevant databases, conferences, and journals and using keywords (such as sustainable strategies, sustainable manufacturing practices, green manufacturing practices, environmental conscious processes etc.). The insights from the literature review are presented in the following sections.

## **SUSTAINABLE MANUFACTURING PRACTICES**

In the past, green competitive pressure and government legislations were not same for developing and developed countries. But, scarcity of material and energy, the improved environmental consciousness of customers and globalization turned the scenario (Nidumolu et al. 2009). These form the major reason for restructuring organizations stake on sustainable development. Altogether, these reasons force organizations to shift from pollution control strategy to prevention strategy.

Also, based on analysis of process flow diagram (Figure 1) of the manufacturing process, the identified wastes are released to technosphere and ecosphere. Kleindorfer et al. (2005) suggested employee involvement, waste reduction, energy conservation, and emission control are important internal strategies to enable sustainability of organizations. Also, Rashid et al. (2008) pointed out, for enabling sustainable material unitization: waste minimization, material efficiency, resource efficiency and eco-efficiency as the critical strategy. However, sustainable manufacturing practices have three perspectives namely material, system and process (Vimal et al. 2014). Sustainable manufacturing practices focus on input materials, processes, Transportation, packaging and disposal after use phase, among others. Of the life cycle stages, material and manufacturing processes are found to be significant as far as the environment is considered.

Considering the process flow diagram of manufacturing processes and after through literature review, five sustainable manufacturing strategies which gain huge interest among researchers and practitioners are Energy modeling and optimization studies, Employee skill training and involvement program, process emission studies, process parameters optimization considering sustainability and waste minimization and disposal strategies.

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