Chapter 13
Using Six Sigma to Achieve Sustainable Manufacturing

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ABSTRACT

Sustainability has been widely discussed from different points of view. Manufacturing is contributing a critical part of noncompliance to environment and human rights in the modern society. While a lot of companies are seeking strategies to either promote corporation image or stimulate employees' work passion, most of research and guidelines are focusing on how to measure the sustainability based on the cases from big firms. Most of manufacturing firms are medium and small sized; they are searching for a comprehensive and systematical way to implement sustainability practice step by step without using very experienced professionals. This chapter is supplying a systematic framework for firms to achieve sustainability in manufacturing environment with the widely used problem solving tool Six Sigma. Inexperienced professionals will be able to implement the sustainability practice from defining problems to achieving leadership in sustainability. It illustrates how to customize the framework content based on individual needs.

INTRODUCTION

Sustainability has been widely discussed from different points of view. As one of the most important parts of Sustainable Supply Chain, Sustainable Manufacturing is inheriting the genes of Sustainable Supply Chain Management. Among all the activities along supply chain, manufacturing has been considered as one of the biggest contributors for environmental pollutants and work-related injuries. Especially the work environment of the manufacturing plants in the developing countries is receiving lots of criticism. Besides, companies across the world are facing the increased cost in materials, energy, and compliance coupled with higher expectations of customers, investors and local communities (Wyckoff, 2005).

Except the needs to achieve the sustainable manufacturing environment, there are also plenty of benefits that have been observed. For example, a 2010 survey of UK-based manufacturing SMEs shows that 56% are already investing in low-carbon technologies and strategies. The global market for low-

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carbon products is already estimated to be worth over USD 5 trillion and growing. Also, the sustainable manufacturing companies are receiving higher financial benefits and better company reputation than those who are facing profound sustainability problems (Wyckoff, 2005).

In order to help companies to achieve sustainable manufacturing environment, there should be flexible and comprehensive framework to help companies who are new into this area to understand their current situations and find corresponding solutions while still can be controlled and improved in a continuous behavior. Most of the articles or handbooks are giving emphasize on how to measure sustainability, while there are rarely comprehensive work routine for a company to start achieving sustainable manufacturing from zero.

Six Sigma as a problem-solving tool has been widely used for different sectors to achieve higher performance in an organization. It supplies a comprehensive framework to solve any critical problems, especially there are a lot of tools can be used.

The combination of Six Sigma and Sustainable Manufacturing can give any organization a systematic framework with abundant tools to make changes to current manufacturing environment in order to achieve sustainability goals. Due to the flexibility and various tools that can be used, different organization can customize its own specific execution routine based on their own resources and vision. It won't restrict to any industry, and it can be also applied to others when the detailed industry information is supplied.

This chapter is contributing to the hot topic related to sustainable manufacturing while it can still be very practical and easy to implement.

The research and work practice mentioned in these literatures are putting a lot of efforts on the concepts of sustainable manufacturing and the measurement methods that can be used to measure the performance of sustainability.

While for a lot of organizations, it is necessary to understand how to align these separate concepts, tools together to successfully achieve sustainable manufacturing from zero. There needs systematical way to help organizations to execute sustainable manufacturing from understanding to real implementation.

At the same time, a lot of measurement metrics that have been mentioned in different literatures are not feasible for small and medium sized organizations to really collect the data, such as carbon dioxide emission. It will be helpful to get comprehensive summary and validation of these metrics for more suitable usage.

What's more, sustainability includes broad range of topics and requirements, in reality not everything can be achieved at the same time. The sequence and interaction of these three factors should be fully investigated to understand the work priorities under different circumstances.

The research objectives are summarized below:

- How do organizations be aware of sustainability?
- What are the proper metrics for sustainable manufacturing?
- How can organizations analyze sustainability problems?
- How can organizations improve sustainability performance?
- How can organizations achieve leadership?

The contribution and differences of this study compared with previous research are also categorized as below: