Chapter 26
A Waste Elimination Process: An Approach for Lean and Sustainable Manufacturing Systems

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ABSTRACT

The continuous improvement using waste elimination has been emphasized as the most important task of modern organizations. Lean manufacturing system has proved its capability to eliminate waste and produce environmental gains. The eight types of waste identified under lean have positive relations to green waste. In this chapter, a waste elimination process is suggested as an approach for lean sustainable outcomes. The process structure contains three consecutive phases: waste documentation, waste analysis, and waste removal. The techniques and tools of each phase are inclusively discussed.

INTRODUCTION

Manufacturing sector is a vital and significant sector contributing to economic development of a country. The connectivity between manufacturing sector and other sectors such as agricultural and services allows a chain impact to be predicted if any ineffective and inefficient activities are performed by the manufacturing sector. The concept of sustainability has played a crucial role in manufacturing to maximize resources utilization in delivering products without causing environmental impact. The concept emphasizes on eco-efficient production processes and hazard-free workplace environment. A key focus on attaining sustainability in manufacturing is on an effective waste removal within the production processes. Eight types of production wastes have been identified within the lean manufacturing system. The occurrence of these waste types combined can be transformed into green waste or environmental footprint (Khan, Jaber, & Glock, 2012). It has been confirmed that the waste removal using lean can generate environmental gains (Moreira, Alves, & Sousa, 2010). Sustainability in lean application, therefore, supports long-term environmental and production improvement.

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This chapter introduces a waste removal process as a technique for sustaining lean manufacturing to result in gaining green environment. The following sections of this chapter entail background of lean manufacturing and sustainability, waste identification tools, waste elimination process and future directions towards green and sustainable manufacturing systems. All sections reflect the chapter objectives which are:

- To identify the commonalities between lean and sustainability within manufacturing context. This will lead to an understanding of interactions between lean and green manufacturing.
- To review the identification tools used for locating waste or non-value added activities inside the manufacturing supply chain.
- To propose a waste elimination process as a lean sustainable approach. This will include three consecutive phases: waste documentation, waste analysis and waste elimination.

BACKGROUND

Continuous improvement of organization features is a guarantee for surviving in the highly competitive environment. Ohno (1988) emphasizes that continuous improvement must never stop. The activities that customers are willing to pay for are identified as value added activities. Whereas, non-value added activities are considered as waste from customers' view. According to Monden (1998), three types of activities are generally implemented within an organization. These three categories are: non value-adding (NVA), necessary but non value-adding (NNVA), and Value adding (VA). The NVA activities are obvious waste that should be entirely eliminated. The NNVA activities may be wasteful but are necessary under the current operating procedures. These activities include walking long distances to pick up parts and transferring tool from one hand to another. The VA activities encompass any activities required to change or process the raw materials or semi-finished products toward what customer wants (Hines & Rich, 1997).

According to Melton (2005), waste is defined as an activity in a process that does not add value to product/service from customer view. Waste elimination is the next step after defining the end user value. However, Melton has overlooked at the components of the process. In general, a process does not contain only activities, but also inputs, tools, and outputs. Therefore, waste elimination should have a broader spectrum rather than just focusing on activities that do not produce value. Seven major types of waste in manufacturing and business processes were identified in the Toyota Production System (TPS) (Ohno, 1988) consisting of overproduction, waiting, unnecessary transport, incorrect processing, excess inventory, unnecessary movement and defects. In addition to the seven types of waste, Womack and Jones (2003) identify the eighth waste type. This type of waste is related to unused employee creativity to improve the processes and practices (Hicks, 2007; Liker, 2004). Recently, the environmental footprints of an organization are one of the competition criteria added to cost, service, quality and lead time (Khan et al., 2012). Therefore, the environmental waste is considered as ninth waste type. The environmental waste includes any activities that could harm human health or environment such as the excessive of substances released to air, water, or land (Dombrowski, Mielke, & Schulze, 2012; Gehin, Zwolinski, & Brissaud, 2008). To facilitate waste reducing/eliminating, five principles of lean are established to facilitate waste reducing/eliminating.