A Study on Green Manufacturing in a Car Battery Manufacturing Plant

Sedef Ergün, Department of Industrial Engineering, Çankaya University, Ankara, Turkey
Sibel Uludağ-Demirer, Department of Environmental Engineering, Karabuk University, Karabuk, Turkey
Suat Kasap, Department of Industrial and Systems Engineering, University of Turkish Aeronautical Association, Ankara, Turkey

ABSTRACT

This study presents an environmental manufacturing system analysis for companies looking for the benefits of environmental management in achieving high productivity levels. When the relationship between environmental costs and manufacturing decisions is examined, it can be seen that the productivity of the company can be increased by adopting a methodology of an environmentally integrated manufacturing system analysis. This study presents such a methodology and the roadmap for generating environmentally friendly and economically favorable alternative waste management solutions is elaborated. The methodology combines data collection, operational analysis of the manufacturing processes, identification of wastes, and evaluation of waste reduction alternatives. The presented methodology is examined in a car battery manufacturing plant, which generates hazardous wastes composed of lead. It is aimed to decrease the wastes derived from the production so that the efficiency in raw materials usage is increased and the need for recycling the hazardous wastes is decreased.

Keywords: Car Battery Manufacturing, Cleaner Production, Environmental Operations Management, Environmentally Integrated Manufacturing, Green Manufacturing, Pollution Prevention

INTRODUCTION

While the limited resources and strict environmental regulations make the manufacturers to adopt effective and powerful environmental management strategies in production, the environmentally aware consumers create new trends in the market, like sustainable consumption, which control and affect decision making. Consequently, not only researchers, but also manufacturing managers are recognizing the importance of environmental management systems used for managing environmental practices. (Porter & van der Linde, 1995; Gupta & Sharma, 1996; Angell & Klassen, 1999; Klassen, 2000; Xigang & Zhaoling, 2000; Sroufe, 2003; Claver et al., 2007).

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A major barrier to the adoption of environmental management systems is that companies often do not know the environmental costs of operating their business and therefore do not know the financial benefits that can be obtained by reducing their environmental impacts. Previously, environmental costs were generally defined as costs dealing with environmental laws, regulations, and taxes. It is now recognized that the true environmental costs includes: costs of resources, waste treatment and disposal costs, the cost of poor environmental reputation, and the cost of paying an environmental risk premium. The calculation and evaluation of environmental costs provide better understanding of the production cost of a product, and that it properly allocates costs to product, process, system or facility. Measuring environmental costs also improves the correctness of the pricing and gives profitability and competitive advantage, therefore increases the overall management system of a company (Porter, 1991).

For this reason, environmentally integrated manufacturing decisions require for the consideration of technical, economic, and ecological aspects of the manufacturing processes simultaneously. Especially the companies using hazardous materials in their production have started to consider environmentally integrated manufacturing systems to decrease their impacts on environment and to prevent pollution at source directly.

Manufacturing decisions should not be made in isolation from decisions in environmental management. In recent years, many production planners and decision makers have started to recognize the role and significance of the integration of economic and environmental efforts in a single production-planning program. New concepts connecting manufacturing practices, pollution control and prevention and operations are recently being used in order to increase the efficiency of converting raw materials into products. Specifically, studies are carried out in order to create decision support tools for analyzing the effects of planning decisions on the amount of product losses. Companies are willing to organize their production systems to enhance resource productivity by adopting an environmental approach. More specifically, green manufacturing, which is defined as a method minimizing waste and pollution achieved through product and process design in manufacturing, has become an important target for companies. Advanced manufacturing systems are promoting green manufacturing strategies with the goal of conserving natural resources for future generations. On the other hand, when the increased competition in the market is taken into account, it can be realized that saving cost and increasing production could also be an incentive for a company to adopt green manufacturing (Rostagi, 2001; Tran, 2003). Based on these kinds of approaches, a company can include environmental principles in the mission statement, incorporate the cleaner production philosophy into product and process design and, consequently, develop an environmental business strategy in order to gain competitive advantage. At this point, it is important to understand the difference between pollution prevention and pollution control. Pollution control covers the elimination of pollution after the waste is generated. On the other hand, pollution prevention covers the modification/redesign of the production process and the introduction of new technologies throughout the product life-cycle to identify the source of the problem. A company adopting traditional pollution control methods focuses on its activity on the short term. In this context, the company sets as its main aim to carry out environmental impact correcting actions that do not entail the development of new skills needed to manage new environmental processes. Therefore, it is seen that traditional pollution control methods are practically inefficient compared to prevention methods. Therefore it is clear that preventing environmental damage is cheaper and more effective than attempting to manage or fix it. Pollution prevention has replaced the traditional pollution control methods and has become an important research topic for the process design (Claver et al., 2007; Xigang & Zhaoling, 2000). There are many studies demonstrating that pollution prevention is almost the most cost-effective constituent of integrated waste.
Carbon Price Drivers: An Updated Literature Review
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