Chapter 50
An Environmentally Integrated Manufacturing Analysis Combined with Waste Management in a Car Battery Manufacturing Plant

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ABSTRACT

This chapter presents an environmentally integrated 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 using an environmentally integrated manufacturing system analysis methodology. Therefore, such a methodology is presented 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.

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INTRODUCTION

Manufacturing companies are now aware that whether to implement sustainable environment and resource management practices or not is no longer a choice for them. Companies operate in a world of dynamic competition in which technology, production and manufacturing processes, customer needs and, environmental regulations are constantly changing. Therefore, companies should constantly find innovative solutions to survive under the pressure of competitors and regulators. The increasingly strict environmental regulations combined with the improving consciousness of consumers for environmentally friendly products have put manufacturers in a precarious situation. Consequently, not only researchers, but also manufacturing managers are recognizing the importance of environmental management systems used for managing environmental practices (Angell and Klassen, 1999; Claver et al., 2007; Gupta and Sharma, 1996; Klassen, 2000; Porter and van der Linde, 1995; Sroufe, 2003; Xigang and Zhaoling, 2000).

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. 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.

This chapter presents a methodology for the environmentally integrated manufacturing system analysis for companies aiming to achieve the benefits of environmental management in obtaining high productivity levels. The aim of the methodology is the reduction of wastes derived from the manufacturing processes. The wastes produced during the manufacturing process are important cost issues for manufacturers. Waste of raw material creates important costs and environmental effects, especially when it is hazardous. For the case of using hazardous raw materials, the wastes derived from the manufacturing processes can not be sent to trash, instead they are sent to the recycling or treatment facility. Obviously, wastes that can not be used within the facility create inefficiency in the usage of raw materials. Therefore, the problem considered is to decrease the formation of wastes in order to decrease waste management costs and improve raw material usage. One solution to this problem is to use an environmentally integrated manufacturing system point of view aiming to decrease product losses, while reducing costs and improving profitability. The presented methodology is examined in a car battery manufacturing plant since any improvement to reduce wastes in this company will be yielding immediate environmental benefits since the waste usually consists of lead, which is hazardous. This application forms also an example about the achievability of "cleaner" production philosophies in the manufacturing sector using hazardous raw materials. The presented methodology is designed in a way that its implementation