

## Chapter 44

# Development of Key Performance Measures for Sustainable Manufacturing in Global SMEs

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### ABSTRACT

*Sustainable manufacturing strives to produce the goods by minimizing negative environmental impact and reducing the resource consumptions. It also strives for safety of employee and community while maintaining an affordable cost. This study focuses on the development of a set of measures and metrics for assessing sustainability performance of manufacturing SMEs. In this study, various literatures on sustainable manufacturing performance measurement, green manufacturing, traditional manufacturing performance measurement and performance measurements in manufacturing small and medium enterprises (SMEs) are reviewed. Triple Bottom Line (TBL) is considered as framework in order to establish the relevant measures in an effective and comprehensive manner. The measures for performance measurements are classified in the three aspects of TBL known as economic, environmental and social. Therefore, 6 measures with 26 indicators, 8 measures with 31 indicators and 3 measures with 23 indicators were identified for economic, environmental and social aspects respectively. To establish the importance and applicability of developed measures, a survey will be conducted among the experts from academics and industries. Using survey results, a sustainability performance measurement model will be developed and presented.*

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## **1. INTRODUCTION**

Sustainable development has become a major concern in all aspects of our activities (Linton et al., 2007). Sustainable development endeavors to meet the need of present without compromising the ability of future generations to meet their requirements (Brundtland, 1987). Sustainable manufacturing is a subset of the broader set of sustainable development. It is a fact that industrial productions are accompanied by various environmental and social concerns at different stages of the production processes (Kemp, 1994; Seuring & Muller, 2008). The adoption of sustainable manufacturing is a viable option in combating these production concerns. Sustainable manufacturing strives to minimize negative environmental effect and conserve natural resources. It also focuses on the products and processes which are economically sound and safe for employee and community (ITA, 2007). Sustainable manufacturing focuses on the organizations that make products or services (Fan et al., 2003).

Larger organizations are adopting sustainable practices in their manufacturing operations due to pressures from consumers, regulators and community (Lee, 2009). In order to achieve better sustainability performance of supply chain, larger enterprises extend these practices to their suppliers. SMEs constitute about 80% of these suppliers (Moore & Manring, 2009). However, SMEs lack personalized management, adequate funds and resources, flexibility, suitable structure, adequate number of customers, access to larger market and adequate knowledge (Alshawhi et al., 2011; Ciliberti et al., 2008). Based on these characteristics, sustainable manufacturing in SMEs cannot be considered as a miniaturized version of larger organization (Alshawhi et al., 2011). Significant attention has been paid to sustainable manufacturing in general, but it is evident from literature that there is lack of research on developing the tools and techniques for sustainable manufacturing in SMEs. SMEs are different from larger organizations and tools applicable to larger organizations may not be applicable to SMEs (Alshawhi et al., 2011).

In this study, an attempt has been made to integrate sustainable manufacturing indicators with traditional performance indicators using TBL framework. As a result, an initial set of key performance measures and indicators for sustainable manufacturing evaluation are proposed considering the characteristics of manufacturing SMEs.

## **2. LITERATURE REVIEW**

### **2.1 Sustainable Manufacturing and SMEs**

In recent decades, sustainable manufacturing concepts and practices have been adopted in larger companies. However, SMEs often lack the awareness, expertise, skills, finance, and human resources to incorporate the required changes for sustainability within the organization (Lee, 2009). In an empirical study, Hillary (2004) identified barriers and drivers for environmental management system for SMEs. Major barriers are lack of knowledge, training, implementation cost and transient cost. In addition, firm size and characteristics of SMEs are also recognized as barriers for sustainable practices. For SMEs, the drivers for sustainability are customers, government, local community, employees, insurers, banks and larger companies (Hillary, 2004). At present, SMEs are adopting sustainability initiatives to enhance their competitiveness due to the pressure from customers, consumers and regulatory bodies (Lee, 2009). For example, larger organizations are adopting sustainable manufacturing practices in their operations as a result of the pressure of directives such as European Union (EU) directives on Waste Electrical and

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