



Using Balanced Scorecard for Sustainable Design-centered Manufacturing

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Abstract

Sustainable design-centered manufacturing (SDM) will create competitive advantages for future new product development. However, selecting and balancing the indicators for economic, environmental, and social sustainability is difficult. In this research, we define the major indicators of social sustainability for development of SDM and propose a Balanced Scorecard method to evaluate the weighting factors among the three pillars and the indicators used to assess each pillar. The algorithm for the analysis is based on Structural Equation Modeling (SEM). A case, using the manufacturing data for Polylactic Acid (PLA), is developed. The results can be adapted to evaluate the performance of outcomes for new product development utilizing SDM.

Keywords: Sustainable design-centered manufacturing, Social sustainability, Balanced Scorecard, Structural Equation Modeling

1 Introduction

Waves of innovation over the last two hundred years have shifted from water power, to fossil fuel use, and may now shift from internet and information computer technology (ICT) to sustainability in the 21st century. As shown in Figure 1, Hargroves' research anticipates that the next wave of innovation will be sustainability (Hargroves, 2012). Organizations will need to incorporate sustainability into future process reengineering. We argue that the integration of design and

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manufacturing for sustainability will generate competitive advantages in the new product development process (Wang, 2012).

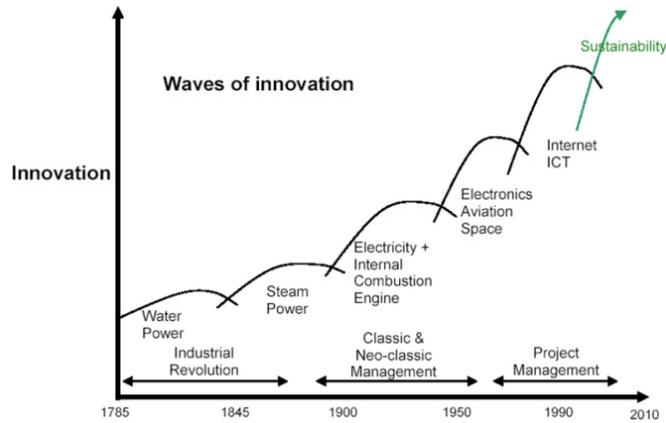


Figure 1: Waves of innovation (Hargroves, 2012)

The goal of a sustainable society includes three components. They are a flourishing economy, social health/social justice, and a sound environment. A sustainable society balances economic, social, and environmental issues as shown in Figure 2 (Diegel, 2010).

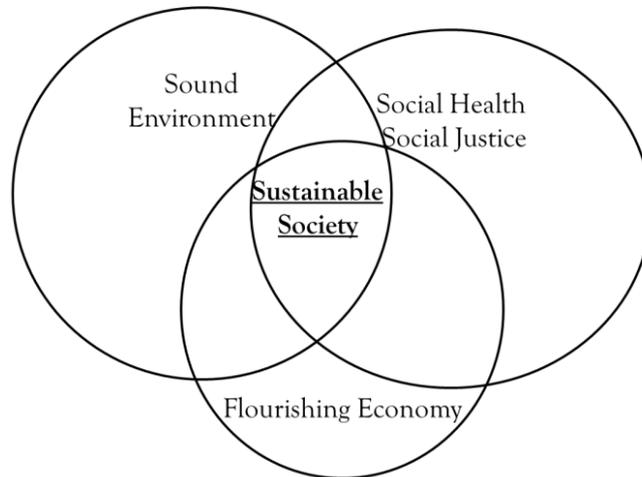


Figure 2: Components of a sustainable future (Diegel, 2010)

Sustainable design-centered manufacturing (SDM), which focuses on sustainability and develops the new manufacturing technologies for the new product design, will lead product development by using a systems approach. Figure 3 shows the shift from design for manufacturing (DFM) to SDM. As companies incorporate sustainability concepts into product design, manufacturing will overlap more completely with sustainability. The core competitive advantage of the manufacturing industry will be based on how to adopt the new concepts of sustainability and design-driven systems when developing new products.

This research develops a new Sustainable Design-centered Manufacturing (SDM) concept and proposes an algorithm by using Balanced Scorecard (BSC) for evaluation of the sustainability of a manufacturing process.

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