

A Strategic Approach to Effective Fab Sustainability

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Ecological consequences of economic development emerged as relevant issues almost four decades ago, and have recently gained more importance as customer-value related strategic issues. In the semiconductor industry, as well as others, innovation in this area has traditionally focused on regulatory compliance and inward looking systems, such as Environmental Management Systems (EMS), Environmental Health and Safety (EHS) systems, and ISO14000. To address the critical future challenge of ecologically sustainable manufacturing while reducing expenses, chipmakers would benefit from including customer (i.e. chipmakers) driven market mechanisms and innovative new tool design in their strategic approach. Essentially taking ecological sustainability out of the confines of being a “cost center” and giving it the opportunity to earn its ability to improve Return on Investment (ROI) for tool suppliers. Improving tool suppliers’ ROI through market mechanisms is preferable to higher operational costs of environmental feature add-ons on future FAB tools. Chipmaker driven value innovation, in conjunction with equipment suppliers, is a corner stone of financially and operationally sound ecological sustainability. Although innovation of sustainable products could benefit from existing cost-related programs, the main challenge is to address the other variable affecting customer-value; which is customer benefit-related research. This approach would tackle design, customer involvement, and subsequent adoption of novel products.

This paper presents an alternative innovation framework that addresses the relatively neglected relationship between the need for improved market outcomes based on the actual creation of customer value (e.g. increased benefits and/or lower costs) through the adoption of ecologically sustainable new product development practices.

The paper features an overview of recent research streams ranging from high-level organizational perspectives to detailed operational strategies. Conceptual and practical differences and similarities between this proposed strategic framework and the old dichotomous context are highlighted. We offer a methodology that leverages the corner stone of innovation, the “fuzzy front end” of product or process design to converge ecological and economic product development into ecologically sustainable growth for the semiconductor industry. The goal is to ensure that ecological sustainability does not evolve into a trap where short-term benefits are gained at the long-term expense of customer value creation and industry growth. Business models that will create customer value while minimizing the ecological impact of the product are needed. Our proposed approach draws on multiple disciplines including the natural sciences used to measure ecological footprints of products or processes, marketing in its role as the voice of the customer, and the social sciences that explain patterns of market behavior.

The emerging sustaining and greening paradigm has the potential to cause discontinuities in markets, industries, and technologies with corresponding impacts on operations and financial results. The need is apparent for new strategies that will reduce the ecological footprint of new products throughout the design, development, production, use, and end-of-life cycle. This paper posits a practical model for ecologically sustainable product development that leverages the “fuzzy front end” of product (and process) design to favorably impact financial outcomes.