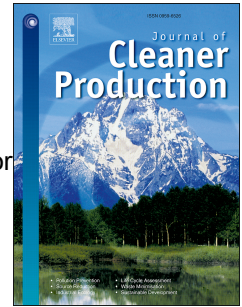


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Improving sustainability performance in early phases of product design: a checklist for sustainable product development tested in the automotive industry

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Abstract:

In the early phases of product development, it is important to both reduce costs and improve a product's sustainability performance. Insufficient data are available on the costs and sustainability aspects of innovative concepts such as automotive lightweight design, which require the application of new materials and processes. The lack of information and high degree of uncertainty hinder the use of traditional sustainability evaluation tools such as Life Cycle Assessment during these early phases. Tools used in eco-design and sustainable design have disadvantages since they either focus on only one sustainability dimension, require quantitative data about materials and processes, or cannot be applied by designers and engineers. To overcome these disadvantages, a new checklist for Sustainable Product Development (CSPD) was developed in close collaboration with practitioners. The CSPD allows the qualitative assessment of environmental, economic and social aspects during the early phases of product development while considering a full life cycle perspective. It provides the methodological foundation for an iterative process, in which improvement tasks related to sustainability are defined that must be completed by the engineers. The applicability of the CSPD with reference to a wide range of technologies was evaluated and tested in a case study that included nine automotive lightweight technologies. This case study revealed that the developed tool helped designers and engineers assess and improve the sustainability performance of a technology and that it stimulated processes of collaboration and information exchange within and between organizations.

Key Words:

Sustainable product development, design for sustainability, eco-design, framework for strategic sustainable development, automotive industry, lightweight materials

1. Introduction

Over the past decade, the topic of sustainable development has gained importance in society and business. The development of this topic has been driven by increasingly stringent regulations in different industry sectors, higher potentials for product diversification and increased public awareness (de Medeiros et al., 2013). In the automotive industry, which is in the focus of this paper, sustainable development is of particular importance. Members of this industry need to comply with environmental standards and meet societal requirements, but also maintain a competitive edge in a rapidly-changing business environment characterized by fluctuating customer demands, new legislations and stiff competition (Maxwell and van der Vorst, 2003; Zhu et al., 2007).

Regulations that are related to sustainability such as the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulations, the Restriction of Hazardous Substances Directive (RoHS) or the Directive on End-of-Life Vehicles (ELV) force automotive companies to consider sustainability issues during their product development (European Parliament and Council of the European Union, 2000, 2006; European Commission, 2002). In response to these legal and consumer pressures, automotive companies have initiated activities that address sustainability, such as considering the end of life phase during the design process or reducing vehicular weight in order to improve fuel efficiency

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