

Simulation Aided Life Cycle Sustainability Assessment Framework for Manufacturing Design and Management

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Abstract : Decision making for sustainable manufacturing design and management requires critical considerations due to the complexity and partly conflicting issues of economic, social and environmental factors. Although there are tools capable of assessing the combination of one or two of the sustainability factors, the frameworks have not adequately integrated all the three factors. Case study and review of existing simulation applications also shows the approach lacks integration of the sustainability factors. In this paper we discussed the development of a simulation based framework for support of a holistic assessment of sustainable manufacturing design and management. To achieve this, a strategic approach is introduced to investigate the strengths and weaknesses of the existing decision supporting tools. Investigation reveals that Discrete Event Simulation (DES) can serve as a rock base for other Life Cycle Analysis frameworks. Simio-DES application optimizes systems for both economic and competitive advantage, Granta CES EduPack and SimaPro collate data for Material Flow Analysis and environmental Life Cycle Assessment, while social and stakeholders' analysis is supported by Analytical Hierarchy Process, a Multi-Criteria Decision Analysis method. Such a common and integrated framework creates a platform for companies to build a computer simulation model of a real system and assess the impact of alternative solutions before implementing a chosen solution.

Keywords : discrete event simulation, life cycle sustainability analysis, manufacturing, sustainability

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