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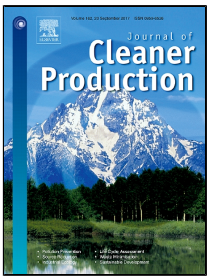

A hybridised framework combining integrated methods for environmental life cycle assessment and life cycle costing

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A hybridised framework combining integrated methods for environmental life cycle assessment and life cycle costing

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Highlights

- Critical literature review on combined environmental Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) methods
- Identification of six types of LCA-LCC integration
- A novel hybridised framework to comprehensively analyse and manage environmental and economic performance

Abstract

For over twenty years, researchers and practitioners have been developing and implementing different methods for combining environmental and economic analysis of products, technologies and systems. However, there is little evidence that one generally accepted method exists. Due to the diversity of different methods there has been, surprisingly, no detailed investigation of the different methods, the interrelationship between methods, and more importantly how they can advance integrated methods for Life Cycle Assessment (LCA) and Life Cycle Costing (LCC). In this paper, a novel hybridised framework is presented combining six integrated methods which were identified after an extensive and critical literature review for environmental life cycle assessment and life cycle costing. The hybridised framework is the first of its kind and aims to provide decision-makers a comprehensive method to navigate environmental and economic analysis. The key features are: (1) integrated framework capable of carrying out six types of LCA and LCC integration, (2) inclusion of multiple perspectives for decision-making, (3) decision making process to select different methods for system analysis and system integration, (4) procedures for Conventional Life Cycle Costing (CLCC) and Environmental Life Cycle Costing (ELCC), (5) total costs including external 'eco-costs' of environmental LCA impacts, (6) hybrid LCA combining benefits of both process and Economic-Input-Output (EIO)-LCA, (7) system optimisation by Multi-Objective Linear Programming (MOLP), (8) hybrid MCDA method combining the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Analytical Hierarchy Process (AHP), (9) Eco-efficiency (EE) index performance and alternative evaluation, (10) a range of graphical tools to interpret integrated LCA and LCC analysis, and (11) management of environmental and economic analysis by continuous improvement. Overall, the hybridised framework accommodates a wide array of different decision-making scenarios