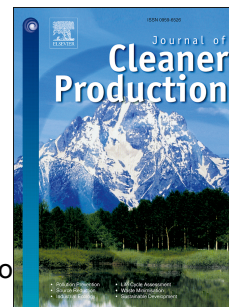


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## Integrating Life Cycle Assessment in the Product Development Process: A Methodological Approach

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### Abstract

Discussions on sustainable development are increasingly present and essential in the current scenario. In this sense, Life Cycle Assessment (LCA) is an important tool to help ensure adequate sustainability by assessing products' environmental impacts in the development stage. This work aims to propose a methodology for LCA integration in the product development process. The proposed methodology was conducted in three macro phases: Pre-integration, Integration and Post-integration. These macro phases consist of four stages: choice of the reference product, LCA of the reference product, LCA integration in the product development process (PDP) and analysis of LCA integration in the PDP. Each stage has specific activities to perform. In LCA integration in the PDP stage, actions are presented for integration in each phase of the PDP and the analysis of the results of the integration is carried out through an assessment matrix that considers the impact categories and the phases of the product life cycle. The validation of the proposed methodology was given through an example for the development of a softener package, assisted by the Umberto LCA software NXT Universal. The developed methodology can help companies in the process of developing more sustainable products.

**Keywords:** Life Cycle Thinking (LCT); Product Development; Integration; Methodology.

### Abbreviations

A-LCA	Attributional LCA
C-LCA	Consequential LCA
DfE	Design for Environment
DfEM	Design for Energy Minimization
DfS	Design for Sustainability
DI	Degree of Improvement
IC	Impact Categories
ISO	International Standardisation Organisation
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
LCI	Life Cycle Inventory
LCIA	Life Cycle Inventory Assessment
LCT	Life Cycle Thinking
PDP	Product Development Process
PLC	Product Life Cycle
SETAC	Society of Environmental Toxicology and Chemistry
S-LCA	Social Life Cycle Assessment

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