Weighting and Aggregation in Life Cycle Assessment: Do Present Aggregated Single Scores Provide Correct Decision Support?

This study investigates the prevailing practice of obtaining single scores in life cycle assessment (LCA) and identifies potential lacunas in impact assessment methodology related to the results of aggregation into endpoints and single scores. In order to conduct this investigation, a detailed approach was adopted to facilitate identification of three main problems related to the single-score calculation approach. The prevailing ReCiPe single-score calculation method does not account for either the effect of so-called dominating alternatives (i.e., alternatives having high values across all endpoints) or the interdependency of the indicators being aggregated. It was also found that the simple linear weighted sum method, presently used for obtaining single scores, is not capable of accounting for the effect of weighting schemes and thus cannot realistically represent stakeholders’ perspectives. Finally, we propose a distance-based multiple attribute decision-making method for use in obtaining single scores. This method was found to be more suitable, given that it takes into account the weighting schemes and types of indicators in the process of estimating single scores. The new single-score calculation method proposed here is considered ideal for environmental decision-making problems in the context of life cycle sustainability assessment. Thus, it is also ideal for situations in which more-complex decision-making situations will emerge by combining LCA indicators (midpoints or endpoints) with other indicators representing the performance of a system from economic and social perspectives.