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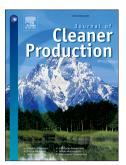
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Developing Life Cycle Sustainability Assessment methodology by

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17 Abstract

18 The production and use of transportation fuels can lead to sustainability impacts. Assessing them

- 19 simultaneously in a holistic way is a challenge. This paper examines methodology for assessing the
- sustainability performance of products in a more integrated way, including a broad range of social
- 21 impacts. Life Cycle Sustainability Assessment (LCSA) methodology is applied for this assessment.
- 22 LSCA often constitutes of the integration of results from social LCA (S-LCA), environmental life cycle
- assessment (E-LCA) and life cycle costing (LCC). In this study, an S-LCA from an earlier project is
- extended with a positive social aspect, as well as refined and detailed. E-LCA and LCC results are built
- 25 from LCA database and literature. Multi Criteria Decision Analysis (MCDA) methodology is applied to 26 integrate the results from the three different assessments into an LCSA. The weighting of key
- sustainability dimensions in the MCDA is performed in different ways, where the sustainability
- 28 dimensions are prioritized differently priority based on the assumed values of different stakeholder
- 29 profiles (Egalitarian, Hierarchist, and Individualist). The developed methodology is tested on selected
- 30 biomass based and fossil transportation fuels ethanol produced from Brazilian sugarcane and US
- corn/maize, and petrol produced from Russian and Nigerian crude oils, where it delineates
- 32 differences in sustainability performance between products assessed. The outcome in terms of relative
- ranking of the transportation fuel chains based on sustainability performance differs when applying
 different decision-maker profiles. This result highlights and supports views that there is no one single
- different decision-maker profiles. This result highlights and supports views that there is no one single
 answer regarding which of the alternatives that is most sustainable. Rather, it depends strongly upon
- the worldview and values held by the decision maker. A key conclusion is that sustainability
- assessments should pay more attention to potential differences in underlying values held by key
- 38 stakeholders in relevant societal contexts. The LCSA methodology still faces challenges regarding
- 39 results integration but MCDA in combination with stakeholder profiles appears to be a useful
- 40 approach to build on further.
- 41 Keywords: LCSA, weighting, values, stakeholders, transport, biofuels

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