

## **Environmental sustainability of integrated production in bio-refineries**

Topic: Effects of Investments

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In the context of developing bio-economy, bio-refineries play a critical role to recycle a large variety of wastes, co-products, and by-products from different agricultural and industrial supply chains (SC). Consequently, their contribution to environmental sustainability is considerable. This paper aims at measuring the environmental sustainability of integrated bio-refineries that produce multiple products via closing the material/energy/waste loops through their SC. The empirical case study is based on the bio-refinery being constructed in Sardinia (Italy). An enterprise input-output (EIO) model is used to quantify material/energy/waste flows of the bio-refinery under different operational efficiency scenarios. Scenarios contain sensitivity analysis for critical operational variables, e.g. productivity rate, use of different biomass mixes, fluctuating transportation distances. The EIO model serves as a planning tool for the involved companies of the SC. For each scenario, environmental performance indicators are measured and compared. Results of the study will assist the SC actors to implement the best-environmentally-performing scenarios and the proposed EIO model enables the bio-refinery SC actors to make efficient resource planning for their production systems.

Keywords: enterprise input-output analysis, bio-refineries, environmental sustainability