

The role of bio-product supply chains in regional bio-economy: A sustainability analysis with input-output modelling

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In the recent the diffusion of bio-economy concept has accelerated as the role of bio-resources to sustain regional development has been expanding. Having the advantage of multiple output production and energy recovery from secondary wastes, bio-resources have an important contribution to the sustainable development of regions.

Such a contribution is strongly dependent on the integration of different supply chains traditionally located in different sectors, which can be connected via waste and by-product valorisation. As the input-output modelling is capable of tracing primary and main inputs, wastes, by-products, and secondary wastes, it is particularly useful to assess the resource efficiency, waste reduction, and added-value creation in the integration of such supply chains.

This paper adopts an input-output model to measure the environmental sustainability of innovative bio-product supply chains using thistle as a second-generation biomass to produce bio-oil, animal feed, bio-plastics and bio-lubricants. It further aims at computing the energy recovery from the secondary wastes emitted during the production of these products. As the recovered energy is reused within the same supply chains, our model is also capable of assessing the loop-closing impact from an energy-efficiency perspective.

The practical contributions of this paper are highly relevant for traditionally separate sectors located in the region since it provides a holistic environmental performance analysis and discusses new business models to achieve chain integration. The paper also theoretically contributes to the bio-economy literature as the investigated production processes are recently developed and their products have been recently introduced in the market.