How Far is an Input-Output Production System from Perfect Industrial Symbiosis?

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Industrial symbiosis (IS) has been gaining more attention in the production economics as the pressure on companies increases for reduction of waste emissions as well as primary resource use. This has pushed the companies to seek for alternative cooperators to integrate into their production chains while reducing environmental impacts as well as saving costs. So, in future markets, the geographic proximity to alternative suppliers will play a major role as the companies will testimony the positive returns of sustainable production and embed it into company culture. Future environmental legislations will also drive the decisions of companies.
Therefore, the aim of this paper is to understand the dynamics of future industrial zones functioning on the basis of IS principles. To this aim, we first design an ideal industrial zone based on perfect IS adopting an input-output (IO) approach where complete substitution of primary resources by wastes is assumed. Then, we measure the distance of the production processes and chains from perfect symbiosis in real life cases and propose a set of policies to make the system approach to the perfect symbiosis state. Perfect symbiosis is defined for one waste and then multi-waste cases and the practical solutions are suggested to understand on which waste to construct the perfect IS.
The proposed approach is sustained by a case study from Santa Croce sull'Arno industrial district of tannery where recycling of chrome liquors, carnasse, and wastewater are investigated in leather, protein hydro lysates, and plastophil production chains.
Results show that it is possible to obtain perfect symbiosis for two waste types pointing out the benefits of IS and how to achieve them in practice. Policy implications of this paper can be very useful for future production zone design as well as for using IS as a sustainable regional development mechanism.

Keywords: sustainable production, industrial symbiosis, input-output modeling, waste minimization