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Influencing industrial transitions towards a zero waste economy by mean of hybrid system modelling of industrial symbiosis

Roberto Pasqualino
 Anglia Ruskin University, United Kingdom

Industrial system and policy making lie at the core of the transition towards a sustainable economy. The interaction between industry, resources and policy is complex, requiring the maximization of synergies from the bottom-up (industrial) and top-down (policy) perspectives within the economy. In this paper, we employ hybrid Agent Based-System Dynamics modelling to capture the complexity of such a system and focus our efforts in the modelling of industrial symbiosis processes (i.e. the ability of one industry in imitating another) and effects on the transition towards a zero-waste economy. The model accounts for different firms each purchasing raw material for production and waste generation. Some industries can purchase the waste as raw material, and each firm can decide whether or not to establish a symbiotic relationship with another to reduce

waste. We find that industrial symbiosis lies at the core of the positive feedback loop which can support transitioning towards a zero-waste economy. The larger the amount of firms adopting symbiosis, the greater the reduction in waste disposal costs and profit, the greater the number of firms engaging in the transition. Policy making can both amplify and oppose to such a feedback effect by mean of public investments and/or tax incentives. The model allows for testing of different assumption in the industrial system while at the same time generating a top-down perspective to take effective policies towards a zero-waste economy. The model can be applied as a generic framework to different economic sectors including manufacturing, energy system and agriculture.

nicola.senesi@uniba.it