

PhD Defence: Julian Torres De Miranda Pinto

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Room Pascal

Sustainable resource management in European steel supply chains

JURY

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SUMMARY

The present thesis delved into the current and future interactions within the European Steel Industry and of it with the environment it is a part of, with the main objective of supporting decision- and policy-making efforts oriented towards sustainability and circularity, helping to shape the future of steel in the European Community. The thesis used the European Steel Industry as a case study to explore the potential benefits of integrating Life Cycle Assessment (LCA) into System Dynamics (SD) under the scopes of Circular Economy and Industrial Ecology. A model representative of the European Steel Industry was built modularly in Stella Architect, following ILCD and ISO guidelines and standards for LCA. Throughout 4 of the 5 articles developed for the present thesis, 21 simulation runs were performed on the aforementioned model: 12 on identifying potential constraints and benefits of End-of-Life policies; 5 assessing the advantages and disadvantages of different Supply Chain Integration (SCI) strategies along European steel supply chains; and 4 addressing the interactions between biophysical and economic dynamics in the steel

market. An additional article was developed using the methodologies of Circles of Sustainability and Sustainable Urban Metabolism to appraise the challenges and contributions of steel as part of servitization initiatives in urban environments. Overall results indicated that integrating LCA into SD was not only feasible and capable of reproducing results, trends and behaviors from previous scientific studies, but also of contributing to both methodologies in different levels.. This approach has potential to interest policy-makers who seek more granularity within the European Steel Industry as well as decision-makers searching for a broader understanding of their operation's dynamics beyond the gates, notably regarding raw material scarcity, resource self-sufficiency, and resource ownership retention. From the results of each article it was observed that, (a) pushing for recycling and reuse could generate interesting medium- to long-term results for circularity, transitioning away from fossil fuels and developing a whole new market around end-of-life services; (b) different SCI approaches can be environmentally and strategically promising; (c) six key biophysical variables can distinctively affect spot prices, future prices, EBITDA margins, capacity utilization, dividend payouts, and costs of steelmaking; and (d) servitization can provide significant benefits to sustainable cities, while also being able to substantially alter the supply-side dynamics of steelmaking, highlighting how important it is for steelmakers to pay close attention to the service-providing initiatives that may concern their clients and products.

KEYWORDS

Life Cycle Assessment, System Dynamics, Europe, Steel, Circular Economy, Industrial Ecology

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