Contribution ID: **104** Type: **Apresentação regular**

Design and planning of sustainable supply chains regulated by government incentives

The design of modern supply chains should account for stimulating economic growth by establishing efficient material and information flows. Yet, the same economic growth trend that fuels supply chains is also contributing to the unsustainable use of resources. This challenge provides the conceptual leverage for this work: to model the government's role as a central agent in the transition toward more sustainable supply chains. The problem is formulated as a mixed-integer bi-level optimization problem. The government is the leader that allocates financial incentives aiming to minimize the environmental impact of technologies and transport modes, favoring low-emission options. The supply chain is the follower that decides on facility openings, technology assignments, production and transportation quantities, and selects transport modes to minimize total costs responding to those incentives. To solve this problem, we propose a deterministic bounding procedure, which is adapted to the hierarchical characteristics of our problem where upper-level constraints include lower-level variables. The convergence is obtained by iteratively computing upper and lower bounds to the leader's objective function.

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Session Classification: Session 4.2 - Sustainable supply chains