MSc thesis project · ReSolVe

Resilient Packaging Sourcing under Sustainability Targets

Problem description

Beverage producers must secure a reliable supply of packaging while meeting increasingly demanding sustainability targets, such as a higher share of recycled content in aluminum cans and glass bottles. Suppliers offering high recycled content may face shortages or disruptions, forcing the producer to switch to sources with lower recycled content. This keeps production running but jeopardizes sustainability performance.

When sustainability targets are evaluated over a reporting period, rather than separately for each product, a producer can build environmental-performance headroom: sourcing higher recycled content early in the period can compensate for less sustainable sourcing after a disruption. This headroom comes at a cost, however, and cannot replace the physical materials needed to keep production running.

This thesis will investigate:

- How should firms jointly determine sourcing commitments, backup capacity, and environmental-performance headroom under uncertain supply conditions?
- When is building environmental headroom more cost-effective than reserving high-recycled-content backup capacity, and when are both needed?
- How do disruption timing, supplier availability, and the ability to adjust procurement decisions affect the value of these strategies?

Thesis assignment

The student will start with a small two-period analytical model with suppliers that differ in cost, recycled content, and disruption risk, to identify when environmental headroom and backup capacity complement or substitute for each other. The student will then develop a stochastic optimization model that jointly determines sourcing commitments, capacity reservations, and post-disruption procurement, while tracking sustainability performance over the planning horizon. The assignment consists of:

- A literature review on resilient and sustainable sourcing, supply disruptions, and stochastic optimization.
- Formulation and implementation of the stochastic optimization model, including service requirements and shortage penalties.
- Computational experiments comparing conventional procurement, environmental headroom, backup capacity, and combined strategies, with sensitivity analysis on disruption timing, costs, targets, and supplier availability.
- Subject to data availability, application to an industrial packaging procurement case within the ReSolVe project.

Possible extensions include environmental-performance pooling across packaging materials, where reporting rules permit, and the effects of changing carbon-related costs and packaging requirements.

Student background

The project suits a student with a strong interest in operations research, mathematical optimization, and sustainable supply chain management. A solid background in mixed-integer programming and experience with Python are expected; familiarity with stochastic optimization is an advantage. The research team will support the student in learning the required methods.

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