IAMB Symposium
IAMB 21st Conference at UQAM, Montreal, Canada

Agent-based Simulation of Post-consumer Glass Recycling

Alexandre Labelle*, Jean-Marc Frayret

Département de Mathématiques et Génie Industriel, École Polytechnique de Montréal, Montreal
email : alexandre.labelle@polymtl.ca

Abstract

In opposition with old-fashioned linear economy, circular economy focuses on maximizing the use of resources before they get ultimately disposed. For instance, end-of-life resources can become new materials by either recycling, remanufacturing or refurbishing used products. However, the main challenge behind this idea is that negative impacts caused by additional transport or transformation – if needed – must not overcome the positive impacts of circular economy. Many popular methods exists to evaluate these impacts such as Life-Cycle and Cost-Benefits analyses. But what happens when studied systems are complex and dynamically evolving? Punctual understanding of the systems may not be as helpful as discovering the influential patterns driving the systems.

This paper therefore aims to conceive a method of analyzing strategies of supply chain development with integrated dynamic components. The post-consumer recycling industry is a good example of such systems. Even though these recycling supply chains can be fairly complex, because of the multiples interactions between stakeholders as well as markets prices and government regulations, there is yet a way to simplify and understand the overall patterns that influence how the mass flows through the supply chain. By focusing on the consumer, which is basically the epicenter node of these particular systems, it is possible to estimate the proportions of material re-directed towards the processing plants, recycling facilities or landfills once discarded.

Considering that consumers are key elements to such supply chains, agent-based modeling and simulation seems appropriate due to the fact that models can be built using a "bottom-up" approach. Using this strategy, in conjunction with empirical studies of consumer behavior, one can create a model and then test its validity against appropriate data. Once the model fit is acceptable, simulation runs can be executed with different supply-chain scenarios. With the assumption that infrastructure's and equipment's environmental and economic costs are already known; scenarios can be compared and results used to support decision making.

On a concluding note, the proposed method does not aim to replace Life Cycle or Cost-Benefits analyses ─ as they are extensive design requirements ─ but rather to enlarge the spectrum of problem that can be solved using those types of impact analyses. Agent-based modeling, paired with empirical studies is believed to be able to achieve methodological progress much needed in the development of *Circular Economy Supply Networks*.