



BLUE CIRCULAR ECONOMY

Optimization-based Integration of Closed- and Open-Loop Supply Chains – A Case Analysis of The Waste Fishing Gear in Norway

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Agenda

- Motivation
- Research approach
- Methodological approach
 - Optimisation based circular supply chain modelling (Hossein Arshad)
 - Parameter estimation in the optimization model – Environmental impact through Life Cycle Assessment LCA (Arron Wilde Tippet)

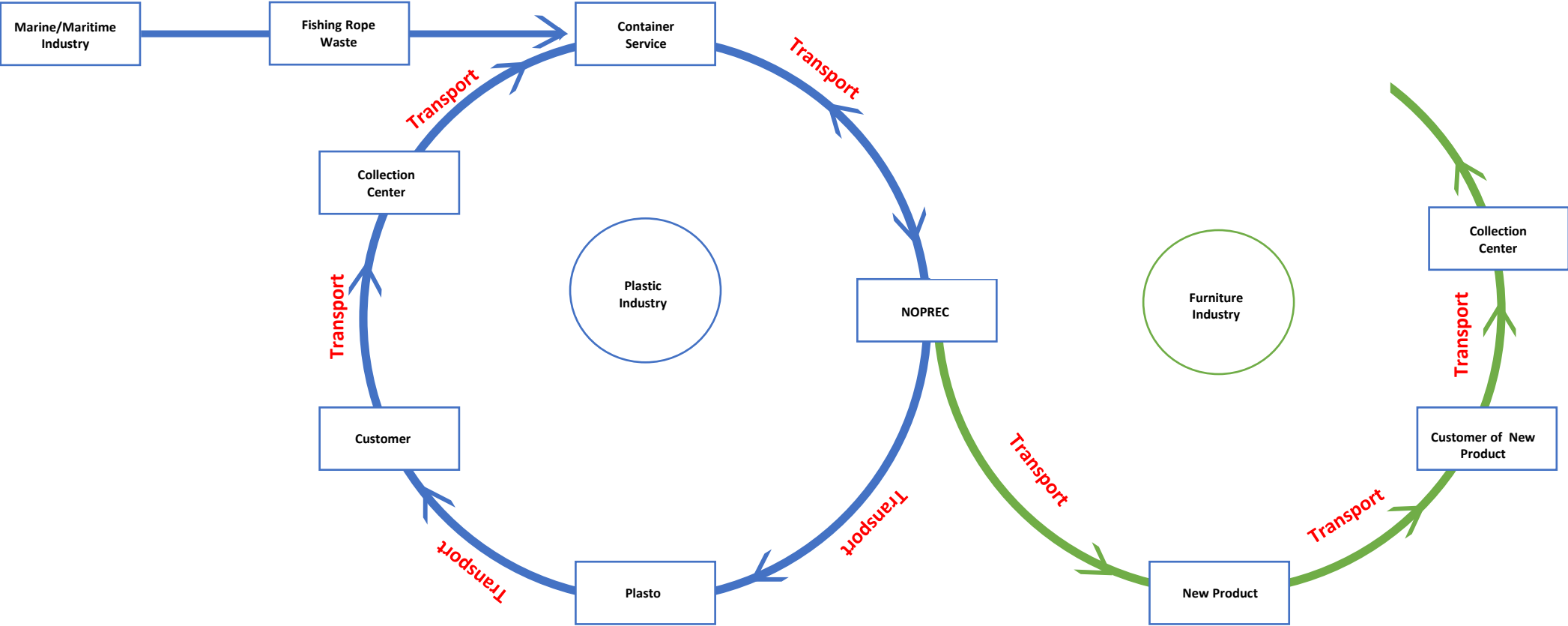
Motivation

- **Global concern** over the impact of marine litter (waste fishing rope) in the oceans
- **Solution** to the global concern: Reduce the environmental impact by transforming Waste Fishing Nets into new business opportunities (reuse and recycling)
 - BCE project - The NOPREC case
- **Research gap:**
 - What is the sustainability impact of recycling through new businesses?
 - A key topic in business-related sustainability research, but there is **limited research on the quantified sustainability impacts** (e.g., by life-cycle assessment and optimization-based approaches) (Lüdeke-Freund et al., 2020).

Research approach

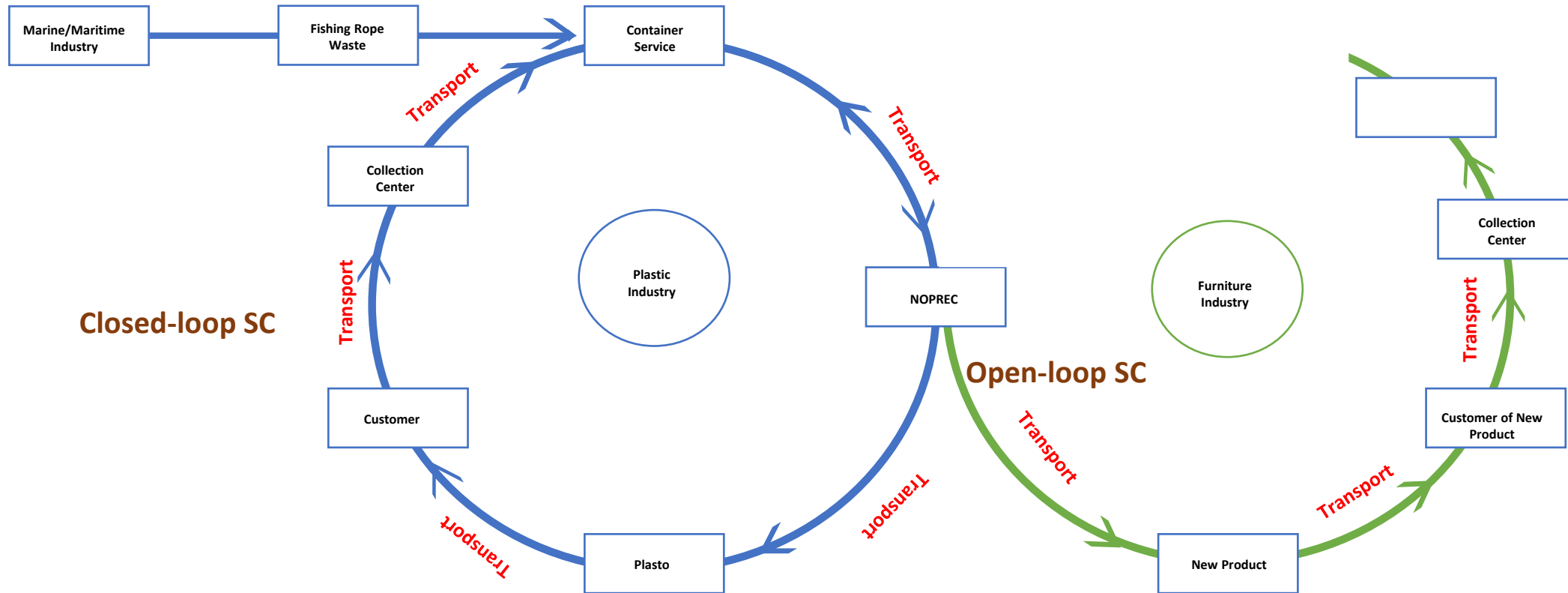
- Main aim: **To develop a circular supply chain network** to transform waste fishing gear into new business opportunities (new marketable products), and by this, to increase resource utilization through the circulation of the resources.
- **How?**
 - By integrating two circular economy strategies:
 - 1) the reuse of materials by original producers in closed loop supply chain (**CLSC**), and
 - 2) the reuse of materials by external supply chains, open-loop supply chains (**OLSC**).

The NOPREC case



Methodological approach

Optimisation-based integration of Closed-Loop and Open-Loop Supply Chains



Optimisation-based integration of CLSC and OLSC

A mixed-integer mathematical programming (MIP) model, with component sharing in the CLSC and OLSC

Objective: Reduce environmental footprint (carbon-equivalent emission), while increasing the circularity of the returns through closed- and open-loop networks

Make decisions on 1) Component flow (forward-backward), and 2) location/allocation of return evaluation facilities, recycling, remanufacturing, refurbishing, and reusing facilities.

Constrained by:

- Known demand must be fully met for each end user.
- The capacities of all facilities of both CLSC and OLSC networks are limited and fixed.
- Costs of transportation, collection, disassembling and fixed costs are known a priori.
- Closing cost of a facility is ignored.
- **Environmental emission costs at each node in the supply chain**

Parameter estimation in the optimisation model

Environmental emission costs at each node in the supply chain

A Life-Cycle Assessment (LCA) of the NOPREC supply chain has been carried out by Arron Wilde Tippett, providing data on environmental impacts across a range of categories

- Global Warming – measured in CO₂ equivalents
- Eutrophication – measured in PO₄ equivalents
- Acidification – measured in SO₂ equivalents
- and many more...
- As well as individual emissions of pollutants to air, land and water...

These can all be used as environmental emission costs within the Circular Economy model.

Planned scientific publication

- Special Issue in Journal of Cleaner Production
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CALL FOR PAPERS: “ASSESSING AND FORECASTING THE SUSTAINABILITY IMPACT OF NEW VENTURES” – SPECIAL ISSUE OF JOURNAL OF CLEANER PRODUCTION – DEADLINE AUGUST 31, 2021

January 12, 2021 · by Florian Lüdeke-Freund · in Calls for Papers · Leave a comment

Aim and Motivation

Entrepreneurs and start-ups are key actors in implementing environmental innovation and new approaches in cleaner production. Thus, analyzing the impact of entrepreneurial ventures is central to cleaner production as well as entrepreneurship research.

The sustainability impact of incumbent firms and their products and services has been a key topic in

Thank You

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